

Advances in materials
highlight battery developments
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CHEMICAL & ENGINEERING

NEWS



World Chemical Outlook

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News of the Week

■ GAF desires merger with Union Carbide. **Page 4**

■ House-passed Superfund bill puts financing burden on oil and chemical industries. **Page 5**

■ Paul V. Smith Jr. elected to third successive term as chairman of ACS Board. **Page 5**

■ Bachelor's degree graduates in science and engineering face a smaller job market this spring, survey indicates. **Page 6**

■ W. R. Grace to buy back 26% of its common stock from West German bank, sell its retail group to help finance repurchase. **Page 6**

Business

Makers of large-volume solvents plagued by rise in imports, slump in demand; no new markets are on the horizon. **Page 9**

Government

Agreement on how a toxic wastes landfill in Niagara, N.Y., will be cleaned up has been reached by Occidental Chemical, the state of New York, and the Environmental Protection Agency. **Page 14**

Science

Why cisplatin is effective against tumors whereas its trans isomer is not is attributed to the fact that the cis-isomer DNA adduct is not easily recognized or repaired by the cell, researchers find. **Page 20**

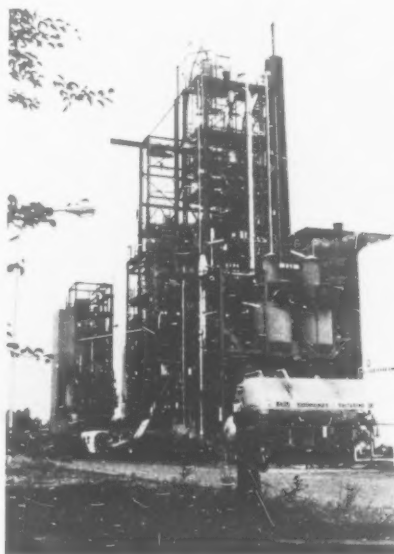
Technology

Improved ceramics for sodium/sulfide batteries and a stabilized iron disulfide electrode for lithium/iron disulfide cell are among recent developments in battery materials. **Page 23**

Books

"The Gene Factory" by John Elkington provides an overview of the birth and rise of the biotechnology industry. **Page 50**

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Special Report

Worldwide, chemical industry growth is sluggish, competition grows fiercer, and attempts to trim costs and improve efficiency are the order of the day. **Page 28**

Major-Volume Solvents Shift To Lower Production Rates

Producers of acetone, synthetic ethanol, and methylene chloride, beset by rising imports and weakening demands, face long slump

Bruce F. Greek, C&EN Houston

Producers of three of the largest-volume organic chemicals used mainly as solvents—acetone, synthetic ethanol, and methylene chloride—have little to be happy about. For acetone, no new markets are ahead that could lead to more production without dependence on coproduct phenol. For ethanol, imports are taking larger and larger shares of its markets. Methylene chloride faces weakening demand for many of its larger uses with no replacements by new or smaller uses on the horizon. And it faces possible environmental pressures.

Acetone differs from ethanol and methylene chloride because of its

status as a coproduct in the manufacture of phenol. Unless the demand for acetone rises far more than is now forecast by industry sources and pushes selling prices higher than is expected, little acetone will be made for its own sake for a long time. What is produced will be as a by-product of phenol. Hence the long-term outlook for acetone depends on demand for phenol, which, in turn, depends on construction. The small amount of acetone capac-

Key Chemicals

ity that is based on isopropyl alcohol consists of relatively small and old plants that probably would be uneconomical to operate if they did not have captive demands.

Some newer uses are helping demand for phenol, but construction still dominates the end uses, leaving acetone's future dependent on construction. Housing, which com-

prises the majority of phenol's consumption in construction, has grown little if at all this year, and may even be slightly down from last year. Prospects for 1986 are similar.

Output of synthetic ethanol has been subjected to severe pressure as a result of the rapid rise in imports during 1985. Little doubt exists that imports from Saudi Arabia will at least hold steady, and possibly rise. Fermentation ethanol also will continue to be imported in volume over the longer term. Although most imported fermentation ethanol is aimed at the gasoline octane additive market, some will ease more into uses as chemical intermediates and less critical solvents.

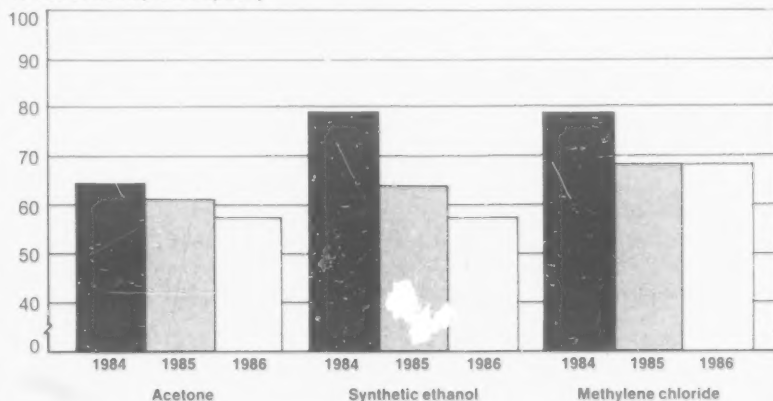
In total ethanol consumption, synthetic material has become a relatively small player, especially if fuel ethanol is included in the total. Synthetic's position likely will continue to decline to the point where synthetic ethanol occupies only the critical solvent markets. If a way can be found to clean up fermentation ethanol sufficiently, then synthetic ethanol production might be ended.

Methylene chloride's problem may be its near total success in capturing markets from other solvents. The result of its success is a rise in its dominance in end uses that are predicted to have no growth or a small long-term decline. Hence, methylene chloride now has no place to expand. Most other sizable markets for methylene chloride are influenced by the declining steel fabrication industries. All of these end uses pushed output of methylene chloride up during the 1970s. For the rest of the 1980s, however, a reversal in output and possible capacity declines seem to be in store.

For details of the near-term outlook for these solvents, please see the following pages.

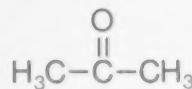
Operating rates decline for solvents

% use of nameplate capacity



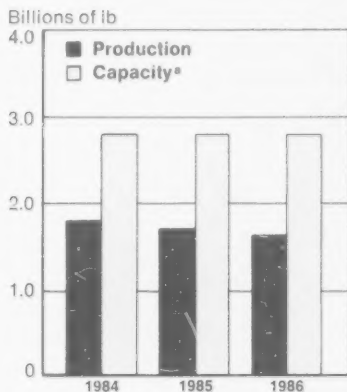
Sources: U.S. International Trade Commission, C&EN estimates

Acetone



- **Production off a bit**
- **Capacity on hold**
- **Prices steady**

PRODUCTION/CAPACITY



a First quarter, excludes about 300 million lb "on standby."

MAJOR PRODUCERS

Allied-Signal, Dow, General Electric, Shell, USS Chemicals

HOW MADE

Coproduction with phenol by oxidation of cumene (isopropyl benzene); dehydrogenation of isopropyl alcohol

MAJOR DERIVATIVES

Methyl and other methacrylates 35%, bisphenol A 10%, methyl isobutyl ketone 10%

MAJOR END USES

Solvents, alone or as derivatives, 50%, fabricated plastics 35%

FOREIGN TRADE

Exports—more than 100 million lb; imports—about 100 million lb

PRICE

About 25 cents per lb

Production of acetone, one of the few major-volume organic chemicals heavily dependent on demand for a coproduct, in this case phenol, is continuing to slide. Acetone output will drop about 5% both this year and next, hitting 1.7 billion lb in 1985 and 1.6 billion lb in 1986; in 1984 production was more than 1.8 billion lb.

About 85% of U.S. acetone capacity is based on oxidation of cumene (isopropyl benzene), which also produces phenol. Demand for phenol depends on demand for housing that requires plywood and particle board as construction materials. Phenol's largest use is in adhesives for plywood and binders for particle board. Both of these are made by means of reactions with formaldehyde.

Two views on the outlook for housing are relevant to the outlook for acetone. One view holds that lower interest rates are causing a decline in the inventory of existing houses and, beginning in the spring of 1986, will cause an increase in demand for new housing. The other view is that changes in household formation, real income, and construction costs offset the effects of lower interest rates and will cause a flat to slightly reduced demand for new housing.

Both views suggest that plywood inventories will change. For example, as housing starts remained flat or declined during the second half of 1985, plywood inventories were cut for a variety of reasons, including savings in the cost of interest. Now, with inventories relatively low, prediction of an upswing in housing and to some extent in commercial construction in 1986 could result in an increase in inventories. Inventory building would push phenol demand, and in turn acetone production, more than actual growth in construction would.

Some analysts argue, however, that there will be no significant rise in housing construction in the first half of 1986. If this happens, phenol demand could grow little or decline. Acetone

production would then follow the same pattern as in 1985.

For marketers of acetone, the situation isn't necessarily bad. Because output was somewhat limited during 1985, prices improved. But late this year, prices, as usual, weakened, as demand for acrylates and solvents slowed with industrial production. Next year, if production also slows another 5% or so (100 million lb), prices might improve more than in 1985, as demand in various uses recovers.

The supply of acetone, however, will not get so tight that prices could rise quickly. Inventories and exports could be reduced to meet demand. Imports also could be increased. Those units that make acetone from isopropyl alcohol could be operated at higher rates to provide more product for the merchant market in contrast to supplying largely captive uses as they do at present.

More than a third of acetone consumed in the U.S. goes to make various methacrylates, about 80% of which is methyl methacrylate. Those methacrylates go into a number of fabricated polymer products such as sheets, coatings, fibers, and molded and extruded items. Some threat to acetone as the raw material for acrylates could come from isobutylene. The threat seems to be delayed now by the demand for isobutylene to make high-octane components for gasoline. This demand is spurred by the decrease in the amounts of lead alkyls allowed in gasoline. Demand for acetone to make acrylates will grow about 5% in 1986.

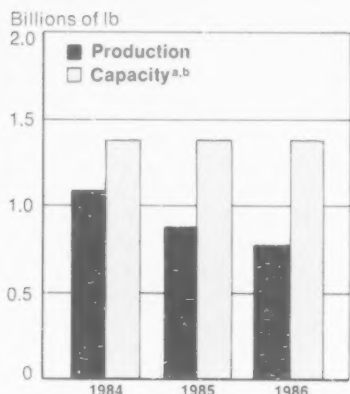
Other uses of acetone—for making bisphenol A and solvents such as methyl isobutyl ketone, methyl isobutyl carbinol, and aldol condensation products, and as a solvent itself—will increase more slowly, generally close to 2% per year. Because such uses are so large, the 1986 growth in demand for acetone will be about 2% overall. That growth probably can be handled without undue stress on the industry, even with an expected decline in production.



Ethanol

- **Production off steeply**
- **Capacity on hold**
- **Prices level**

PRODUCTION/CAPACITY



a Synthetic only. b First quarter, excludes capacity on standby.

MAJOR PRODUCERS

Eastman Chemical, U.S.I. Chemicals, Union Carbide

HOW MADE

Synthetic—direct hydration of ethylene; otherwise fermentation

MAJOR DERIVATIVES

Acetic acid (vinegar) 10%, esters 10%, ethers 10%

MAJOR END USES

Solvents 55% (85% including derivatives), food 10%

FOREIGN TRADE

Exports—declining to less than 10 million lb; imports—rising to more than 500 million lb

PRICE

\$1.80 per gal

Synthetic ethanol production (excluding beverage alcohol), which has been declining rapidly in recent years, is expected to continue its slump through 1986 and possibly later. Any reversal of this situation will depend on a tight control of imports. This year imports of both synthetic and fermentation ethanol likely were several times U.S. output.

The import problem is far worse for producers of fermentation ethanol, which is used in gasoline mixtures for motor fuel, than it is for producers of synthetic ethanol. However, in 1985 a considerable—but impossible to estimate accurately—quantity of synthetic ethanol arrived from Saudi Arabia.

Some imported fermentation ethanol goes to uses formerly supplied by synthetic ethanol, including uses in some solvents and as intermediates for various chemicals. Rising imports of both fermentation and synthetic ethanol caused this year's rather steep decline in output of synthetic ethanol. Production in 1985 will do well to reach 900 million lb, down about 20% from 1984 output of more than 1.1 billion lb. For the first three quarters of 1985, preliminary figures show production of about 730 million lb on an annualized basis. Often, however, a surge in synthetic ethanol production occurs during the fourth quarter. This makes a higher annual total likely.

The decline in production of synthetic ethanol forecast for 1986 will be about half that expected for 1985. Next year's output could total 800 million lb, but probably will be less, if imports continue at current levels or rise slightly.

Falling capacity utilization is hurting the three synthetic ethanol producers. For 1985, the average operating rate is estimated to be less than 65% of nameplate capacity, and for 1986, it is predicted to be less than 60%. This downward trend indicates that some capacity might be shut down. However, a number of producers have captive uses for their ethanol, allowing

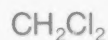
them to keep units operating. But, the make-or-buy decision looms over producers, especially if they have a more profitable use for the ethylene consumed in the ethanol.

Some synthetic ethanol will continue to be needed for certain cosmetic and pharmaceutical solvents in which odor is critically important. Slightly more than half of U.S. synthetic ethanol is used as a solvent, and, of this, about 30% goes into cosmetics. Fashion influences make demand forecasts difficult in cosmetics. Over the near term, growth is predicted to be modest—less than 5% annually.

Other solvent uses of ethanol such as in coatings and inks are under pressure from lower-cost imported material. In certain proprietary uses, only synthetic ethanol will do the job, but in most uses, fermentation ethanol is acceptable. In some applications, especially coatings, isopropyl alcohol also provides competition. Growth in these other solvent applications will remain modest; for most it will be less than 5% annually.

Ethanol is used to make a wide variety of chemicals, with ethyl acrylate, vinegar, various glycol ethers, ethylamines, and ethyl acetate ranking among the larger uses. Each of these products has various uses as well, of which none have strong growth prospects. Because of the inroads of fermentation alcohol, as a group the various chemical uses of synthetic ethanol probably will show a small decline next year, as they are showing in 1985. Use in glycol ethers is especially vulnerable owing to concern over their possible toxicity.

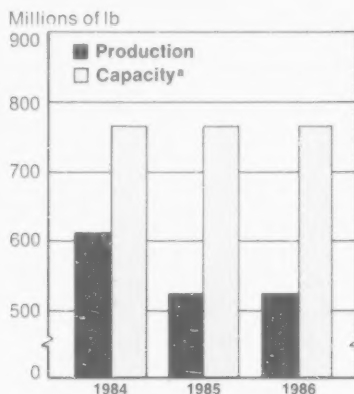
The small growth expected in the aggregate of ethanol's chemical and solvent end uses will be obscured by the rise in its consumption as a motor fuel. If imports of ethanol for fuel use continue to rise in 1986, they still will be diverted into nonfuel uses, which is what caused the declines in production of synthetic ethanol in 1985 and is expected to cause them in 1986.



Methylene chloride

- **Production to hold**
- **Capacity variable**
- **Prices steady**

PRODUCTION/CAPACITY



a First quarter, maximum (actual capacity varies with product mix of chloromethanes).

MAJOR PRODUCERS

Diamond Shamrock, Dow, LCP Chemical, Vulcan

HOW MADE

Chlorination of methane; hydrochlorination of methanol, then chlorination of methyl chloride

MAJOR END USES

Paint remover 30%, aerosols 20%, degreasing agent 10%, chemicals manufacturing 10%, blowing agent 5%

FOREIGN TRADE

Exports—about 50 million lb;
imports—about 50 million lb

PRICE

About 35 cents per lb

Methylene chloride producers have cut output drastically in 1985, and prospects for improvement in 1986 are slim. Compounding the problem, the Environmental Protection Agency has begun its long-awaited study on the possible risks of cancer from exposure to methylene chloride, which is used largely as a solvent.

Current estimates put production of methylene chloride in 1985 at about 520 million lb, or slightly less. That figure is about 15% less than last year's output of 607 million lb estimated by the U.S. International Trade Commission. However, the annualized 1985 production for the first three quarters totals 510 million lb. If the final 1985 estimate is increased as much as was the final 1984 figure over the preliminary estimate, then 1985 production could be as much as 550 million lb. Thus, output would be down only about 10% from 1984.

Production of all four chloromethanes—methylene chloride, methyl chloride, chloroform, and carbon tetrachloride—is down, but not uniformly, from levels in 1984 when recovery from the recession reached its peak. The reason for irregular changes in output is the flexibility that manufacturers have in running plants to make whichever chloromethane is most in demand. Capacity estimates for methylene chloride are the maximum that can be produced, partly at the expense of output of other chloromethanes. Based on this maximum capacity, the 1985 average operating rate for methylene chloride plants is 68% of nameplate.

Manufacturers of methylene chloride would like to increase output this year and next to offset anticipated lower production and sales of chloroform. This decline in sales will result from the modification of a Du Pont chloroform plant that will make Du Pont nearly self-sufficient in its supply of raw material to make dichlorodifluoromethane, used as a refrigerant and in manufacturing fluoropolymers.

Demand for methylene chloride is forecast to remain nearly stagnant in 1986. The end uses are expanding very little and may well shrink, depending on how the public views the results of the EPA toxicity study. Most uses of methylene chloride depend on its solvent properties; relatively small quantities are used as chemical intermediates.

The largest solvent use of methylene chloride is in paint removers. For several years this use grew rapidly as methylene chloride replaced other solvents that came under air pollution control regulations. However, growth has abated recently because demand for paint removers is rising slowly and capture of the markets held by other, older paint remover solvents is almost complete. If more concern develops over toxicity, use in paint removers could decline steeply after 1986.

The second largest use of methylene chloride, that as a propellant in aerosol preparations, also has grown little. Methylene chloride took over much of the market from fluorocarbon propellants because of concern about damage to the atmospheric ozone layer. Methylene chloride apparently causes little damage to the ozone layer because it decomposes relatively rapidly in air. For the near term, growth in this use of methylene chloride will follow closely that of the population and will vary as a result of changes in use of hair sprays and other aerosol products.

The other uses of methylene chloride also rely on its solvent properties. These include industrial cleansers and degreasers, which depend on trends in industrial operations. For example, the shift to less metal processing in making automobiles and other durable goods tends to reduce demand for methylene chloride. A host of small solvent uses account for a large part of consumption, but none of these are increasing fast enough to help much in stemming the general decline in use of methylene chloride.

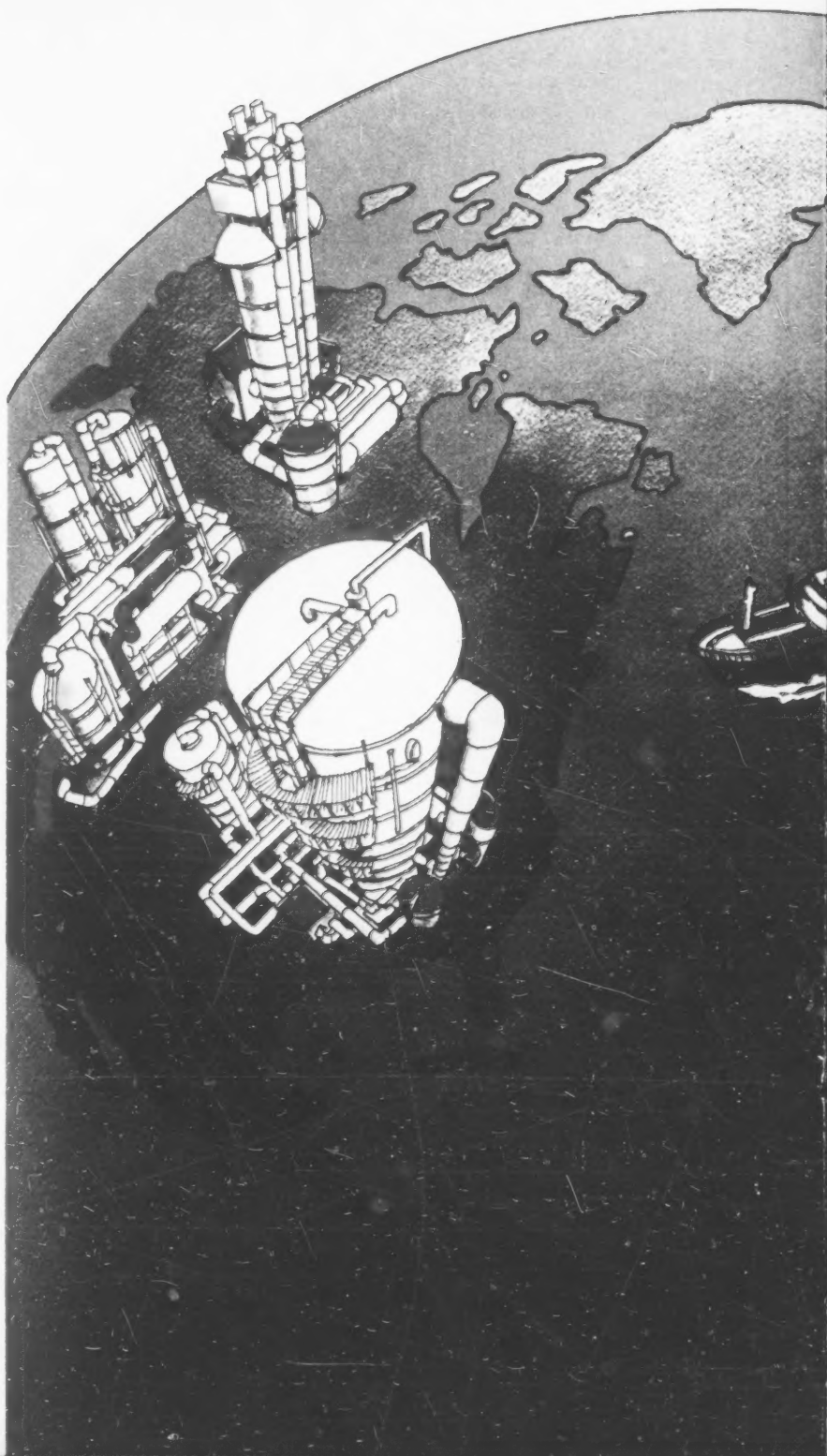
SPECIAL REPORT

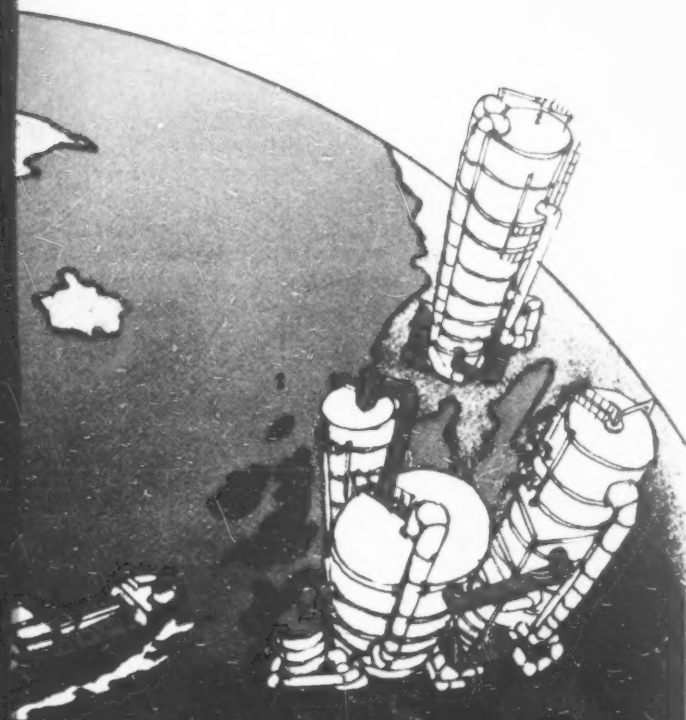
With economic growth turning sluggish in much of the industrialized world, growth in demand for chemicals also is slackening. Chemical producers, as a result, are being forced to slug it out in increasingly competitive markets. Many are being bloodied in the process.

North America is a good example. In the U.S., growth in chemical output has been just about negligible recently. Selling prices are under pressure. Sales are flat. And profits have nosedived. North of the border, Canadian chemical firms likewise are finding earnings unsatisfactory; some domestic markets are anemic and competition for foreign customers is more heated.

Japanese chemical companies, despite a year of strong sales and profits, face similar concerns. A less robust domestic economy coupled with increasing difficulties in maintaining offshore sales suggests that business may soon weaken. In Western Europe, too, business has been relatively healthy. But the European growth pace also is slowing, making the fight for market share more intense.

Both in the U.S. and elsewhere, the chemical industry has been undergoing a massive restructuring. Excess capacity has been shut down and low-profit operations spun off as the industry strives to trim costs and improve efficiency. But the payoff is still uncertain. Competition for worldwide market survival at the same time is heightening.





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Profits slump as demand for chemicals stagnates

Continued economic growth, a weaker dollar, and corporate restructuring may bolster chemical firms' earnings next year

David M. Klefer, C&EN Washington

The U.S. economy has lumbered through 1985 like a rather weary, sluggish giant—fundamentally strong, but not moving forward very fast. And the U.S. chemical industry, as a consequence, has been sorely beset.

Gross national product this year, after adjustment for price changes, is expected to be up only 2 to 3%, with most of the growth coming during the final six months after an anemic 1% growth in 1985's first half. Industrial production likewise is running only about 2% ahead of a year ago. Business continues to be plagued by a widening trade deficit that this year will suck \$125 billion worth of demand out of the U.S. economy. And the astronomical \$212 billion deficit in the federal budget (for fiscal 1985) has eroded business and consumer confidence.

On the plus side, however, inflation seems firmly in check. Consumer prices now are merely 3% above the year-earlier level, and wholesale prices are essentially unchanged. Inflation has not been so low for any extended period in nearly 20 years. Interest rates, too, have fallen. They are at the lowest level of the past five years or more, although in real terms—measured against inflation—they remain disturbingly high.

Nevertheless, the economic climate this year has not been conducive to the health of chemical producers. For the industry as a whole, growth in output has been almost nil. Production of industrial chemicals and synthetic materials, overall, was up less than 3% this past fall from the fall of 1984.

Plastics have set the pace; output will be up 5% or more, although polyvinyl chloride is a notable exception. Elsewhere, however, disappointment is widespread. Production of most of the commodity inorganic and organic chemicals, as well as the big-volume synthetic fibers other than polypropylene, has failed to match 1984 volume.

Selling prices have been similarly disappointing, especially for fertilizers, synthetic fibers, and some plastics. Slack demand, chronic excess capacity, and competition from foreign-made material have kept prices under pressure for more than three years. For all of 1985, industrial chemicals sold at prices that averaged about 1% less than in 1984, although they have recovered slightly as the year closes.

Sales, too, have been flat for producers of industrial chemicals and synthetic materials. During the first half of the year, in fact, sales trailed those of the like 1984 period about 5%. Year-to-year comparisons will be looking a bit better for the second half, if only because sales were far from robust late last year. For 1985 as a whole, though, sales will be about equal to, or a little behind, last year's total.

Worst of all, however, for the industrial chemical industry, profits have been slumping for more than a year. Through this year's first nine months, despite lower energy costs and massive efforts by chemical companies to control operating costs, net income was down more than 20%. The current quarter prob-

ably will not look so bad, again because the comparison will be made against the relatively weak final quarter of 1984. Even so, profits for all of 1985 will lag those of 1984 20%, if not more. That's a far poorer showing than had been expected by most people in the industry. A year ago, the consensus was that earnings probably would rise as much as 10 to 15% this year.

The real level of earnings for 1985 is being clouded by the unprecedented corporate restructuring that has swept the chemical industry. Companies have been shucking off unwanted businesses and trimming their staffs for several years now. But this year, they have been selling or shuttering inefficient, obsolete, and ill-fitting operations and cutting back on personnel through attrition, early retirement, and outright firings to an extent unmatched previously. The efforts reflect a growing long-range interest by many firms to shift the focus of their business from commodity products to specialty chemicals, where competition may be less intense and profitability easier to maintain. The result has been a wave of huge write-offs and other charges that are chipping into 1985 income.

The chemical industry's prospects for the year ahead again will depend on the trend of the nation's overall economy.

The consensus now is that gross national product again will rise slowly but steadily throughout the next 12 months, although unlike this year the greatest growth probably will take place during 1986's first half. For all of 1986, GNP generally is expected to be 2.5 to 4% higher than this year's total. That would be a slight improvement over the growth that is occurring this year.

As 1985 winds down, in fact, the nation's economy seems surprising-

ly free of obvious stresses. Inflation remains comfortably moderate, with consumer prices likely to rise only a bit faster next year than they did during 1985, and energy costs trending lower. A weakening dollar, meanwhile, may well stem the inflow of foreign-made products. Interest rates, although always difficult to forecast, probably will change little in the year ahead after having dropped markedly from their lofty levels of early this year. Finally, consumers, whose incomes are rising, still appear to be in a free-spending mood.

All this should create a favorable market climate for vendors of chemicals. But in the final analysis, the health of the chemical industry is linked to several key markets, for some of which the outlook is at least somewhat cloudy.

Bumper crops and lower sales abroad have depressed prices for farm products, so that farmers' income is down and their heavy load of debt has become ever more burdensome. As a result, sales of both fertilizers and pesticides have been hobbled. And even though lower feedstock costs have eased the pain somewhat, fertilizer prices are severely depressed. The agricultural chemicals business may be no worse next year, but there still is no convincing evidence that it will be significantly better, either, especially since farmers likely will be planting fewer acres with wheat, corn, and other grains.

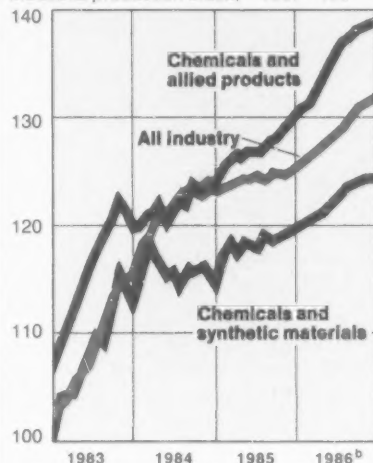
The automobile industry, a big consumer of chemical products, has had an up-and-down year in 1985. Sales were strong when spurred by discount financing programs and rebates, but slumped when such incentives were lifted. Meanwhile, imports have been winning a bigger share of the U.S. market since import quotas on Japanese cars were eased. Foreign cars now have captured about a third of U.S. auto sales.

This year, about 8.2 million cars are being produced in U.S. factories, up about 5% from 1984 to the highest level since 1979's 8.4 million. Total sales of cars this year will be close to 11 million.

Next year, sales most likely will taper off moderately. Ford Motor president Harold A. Poling, for ex-

Chemical production will edge higher in 1986 ...

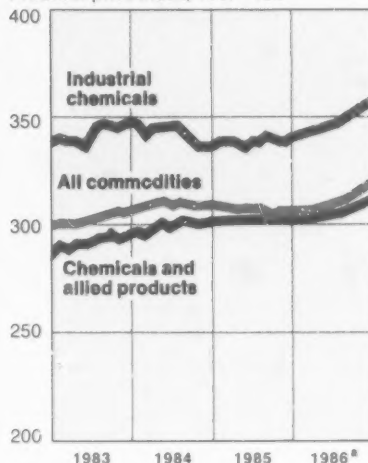
Industrial production index, ^a 1967=100



^a Seasonally adjusted. ^b C&EN estimates. Source: Federal Reserve Board

... while selling prices strengthen a bit ...

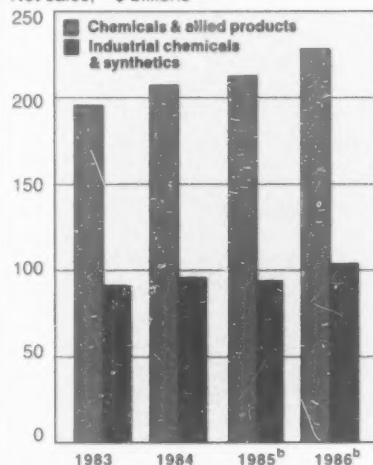
Producer price index, 1967=100



^a C&EN estimates. Source: Bureau of Labor Statistics

... industry sales advance moderately ...

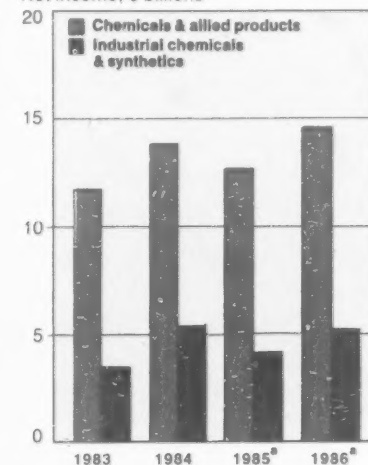
Net sales, ^a \$ billions



^a Excludes sales of foreign subsidiaries. ^b C&EN estimates. Source: Bureau of the Census

... and profits recover from this year's slump

Net income, \$ billions



^a C&EN estimates. Source: Bureau of the Census

ample, estimates that sales will fall to 10.4 million cars, although other forecasters look for a higher total. In any event, imports probably will take a still bigger piece of the total market. That means that U.S. production is likely to skid to 7.6 million vehicles, down 7%. And that, in turn, is no small loss for U.S. chemical producers.

Housing, another big market for plastics, coatings, and fibers, also is an uncertainty. Lower interest rates on mortgages might be expected to

generate higher demand for new houses. And mortgage rates have come down nearly two percentage points in the past 12 months to the lowest level in six years. Even so, home building remains in the doldrums. This year, housing starts will total between 1.7 million and 1.8 million, essentially unchanged from 1984. In part, the reason is that although mortgage rates have fallen, so has inflation. Therefore, the real cost of interest is still high enough to dampen demand. Recent

overbuilding, meanwhile, has created a glut of apartments in many areas. The upshot is that housing is a market that is likely to expand next year, but not by much.

Two important markets for specialty chemicals that have been hard hit during 1985 are oil production and refining and semiconductors and other electronic products. The latter may be poised for a rebound, but the former remains depressed.

The softening of the U.S. dollar will have a broadly favorable impact on demand for chemicals. As the value of the dollar rocketed during the past five years, exports of chemicals of all types expanded less than 10%, but chemical imports climbed nearly 70%. But it is not just in direct trade in chemicals where a strong dollar has undercut demand for U.S.-made chemicals. The chemical content of imported clothing, electronic equipment, cars, and other manufactured goods also has eroded domestic chemical sales. The slump in production of fibers, for example, results in part from the fact that fiber imports are up about 10% this year. Even more of a factor, however, is the sharp increase in imports of foreign-made apparel and other

textile products. Similarly, lackluster sales of agricultural chemicals can be blamed in part on lower sales of U.S. farm products abroad as well as on reduced exports of the chemicals themselves.

The most immediate effect of the weakening of the dollar will be on chemical companies with large overseas operations. They will be able to translate their foreign sales and earnings into U.S. dollars on more favorable terms. The full impact of the dollar's decline, however, probably will not materialize until mid-1986 or later. By then, the price advantage now enjoyed by foreign-made chemicals may have eased enough to make U.S.-produced chemicals more competitive. But many of the inroads made by foreign producers, both in domestic and international markets, in recent years are likely to be permanent.

Thus prospects for the chemical industry are far from clear-cut. Foreign business will be more profitable, in terms of dollars. The industry's costly restructuring probably is still incomplete; even the companies that took the biggest charges this year may find more assets to write down in the next year or two.

Nevertheless, restructuring is likely to be a considerably smaller cost factor in 1986. Meanwhile, the cost savings and enhanced profitability stemming from the restructuring already completed can be expected to have a favorable impact on next year's earnings statements.

Moderate growth next year in the overall economy points to moderate growth for chemicals, as well. Production of industrial chemicals and synthetics, for example, probably will rise at least 3 to 4%. Recent price trends suggest, too, that the industry will benefit to a small extent from a firmer pricing structure. Sales, as a consequence, probably will be 5 to 7% higher.

Profitability, moreover, may be quite significantly enhanced. Lower feedstock costs, lower personnel expenses, and the shutdown of unprofitable operations all bode well for the industry. The upshot is that a rebound in earnings for producers of basic chemicals and synthetic materials of 20 to 25% from this year's depressed results would not be surprising. Even with that strong a showing, however, profits will not be so high as they were in 1984—or, for that matter, in 1981. □

Output of chemicals, generally down this year, will be up slightly in 1986

	1983	1984	1985	1986
INORGANIC CHEMICALS				
Thousands of tons unless otherwise indicated				
Ammonia	14,072	16,192	16,450	16,200
Chlorine gas	9,960	10,724	10,600	10,800
Hydrochloric acid	2,608	2,866	2,800	2,900
Nitric acid	6,768	8,041	7,900	8,000
Oxygen, billions of cu ft	343	375	375	400
Phosphoric acid	9,767	11,111	10,800	11,100
Sodium hydroxide	10,230	11,224	10,800	11,100
Sulfuric acid	37,459	41,802	40,100	41,500

ORGANIC CHEMICALS				
Millions of lb unless otherwise indicated				
Acetic acid	2,807	2,619	2,850	3,000
Acetone	1,859	1,862	1,800	1,900
Acrylonitrile	2,146	2,219	2,300	2,400
Benzene, millions of gal	1,233	1,318	1,400	1,500
Butadiene	2,353	2,827	2,700	2,800
Cumene	3,345	3,754	3,800	4,000
Cyclohexane	1,656	1,994	1,700	2,000
Ethylene	28,680	31,383	30,700	32,200
Ethylene glycol	4,425	4,842	4,600	4,800
Formaldehyde	5,465	5,815	5,800	6,000

	1983	1984	1985	1986
PLASTICS				
Millions of lb				
Methanol	7,982	8,186	6,600	8,000
Phenol	2,638	2,889	2,800	3,000
Phthalic anhydride	838	870	850	900
Propylene	13,959	15,559	15,400	16,200
Styrene	6,802	7,709	7,500	7,900
o-Xylene	781	688	690	740
p-Xylene	4,114	4,264	4,600	4,800

PLASTICS				
Millions of lb				
Polyethylene, high density	5,689	6,085	6,650	6,950
Polyethylene, low density	8,041	8,415	8,800	9,100
Polypropylene	4,433	4,940	5,150	5,400
Polystyrene	3,570	3,838	4,050	4,200
Polyvinyl chloride	6,067	6,760	6,500	6,700

SYNTHETIC FIBERS				
Millions of lb				
Acrylic and modacrylic	679	671	630	620
Nylon	2,419	2,412	2,330	2,400
Olefin and vinyon	906	997	1,200	1,280
Polyester	3,544	3,392	3,340	3,400

Sources: Bureau of the Census, International Trade Commission, Society of the Plastics Industry's Committee on Resins Statistics, Textile Economics Bureau, C&EN estimates (for 1985 and 1986)



U.S. share of world chemical market is shrinking, as is the long-standing U.S. trade surplus in chemicals

Earl V. Anderson, C&EN New York

The foreign trade balance of the U.S. chemical industry is taking it on the chin again this year. And the outlook for U.S. chemical trade in 1986 doesn't seem encouraging either. In part that's because total world trade in chemicals is likely to ebb next year.

After chalking up a healthy 9% growth last year, overall world trade now is showing signs of slowing down. And when total world trade tapers off, world chemical trade tends to follow.

In the face of such widely fluctuating variables as the U.S. dollar's exchange rate, interest rates, and diverse economic growth in various parts of the world, forecasting world trade is no small task. At the beginning of the year, forecasts tended to converge on a 5 to 5.5% increase in world trade for both 1985 and 1986.

Now that international economists can get a more complete view of 1985 and a closer look at 1986, they agree that those forecasts may be too optimistic. The U.S. economy, which has been the locomotive pulling the rest of the world out of recession, didn't perform up to expectations during the first half of

World trade in chemical products may start to decline in 1986

the year. Neither did the economies of many Southeast Asian nations.

Debts continue to stymie many Latin American countries. Meanwhile, less expensive oil is proving to be a burden to most oil-rich countries. They no longer have a wallet full of money to buy manufactured goods from industrialized nations. Saudi Arabia is a prime example.

Economists at the General Agreement on Tariffs and Trade (GATT) put it bluntly. Economic recovery throughout the world is slowing more than expected this year. This, they say, "could signal that the world economy is in danger of slipping back into the anemic performance of the post-1973 era."

As a result, GATT economists now think that final figures on world trade for 1985 will show it to have grown only 4% rather than 5.5%. Estimates for 1986 world trade growth are being scaled down, too.

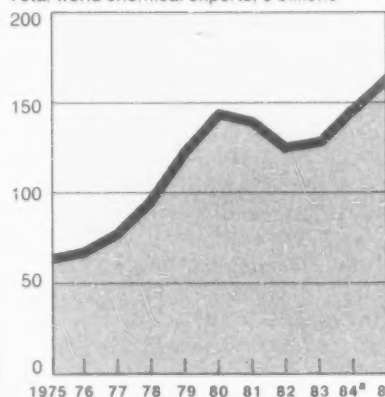
U.S. chemical trade—indeed, all U.S. trade—has not escaped these worldwide trends. The U.S. trade deficit will leap from last year's \$123 billion to about \$150 billion in 1985, based on CIF values for imports that include freight and insurance costs. Using the conventional "customs" basis for valuing imports, the U.S. trade deficit this year probably will be about \$125 billion. The comparable 1984 number was \$108 billion.

Although the U.S. economy has not been so strong as some economists expected it to be, it nevertheless was strong enough to suck in 4% more imports this year (for a total of \$340 billion) than in 1984. Lower crude oil prices cut the U.S. oil import bill 15% to about \$48 billion. Agricultural and commodity imports remained essentially unchanged. The big import gains, then, came in manufactured products.

Although U.S. imports are grow-

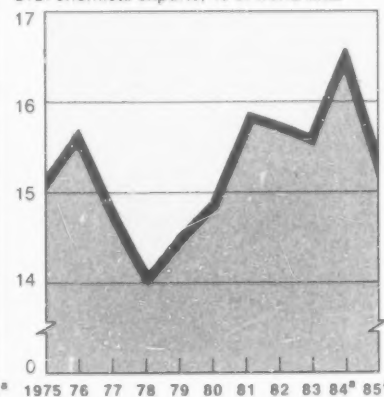
World chemical trade continues to expand . . .

Total world chemical exports, \$ billions



. . . as U.S. share of the world market drops

U.S. chemical exports, % of world total^b



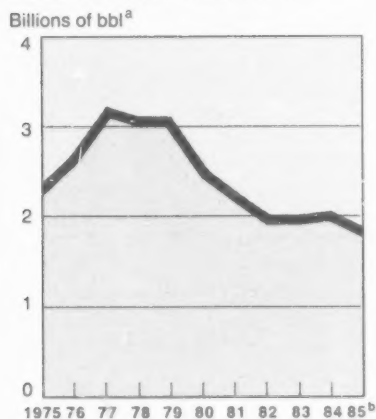
^a C&EN estimates. ^b Defined as U.S. chemical exports as per cent of world chemical exports less U.S. chemical imports. Sources: United Nations, Bureau of the Census

In a lackluster year for chemical exports, drugs and fertilizers shine

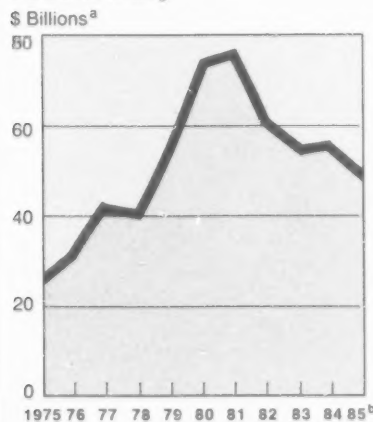
\$ Millions	U.S. chemical exports				U.S. chemical imports			
	1985 ^a	1984	1983	1982	1985 ^a	1984	1983	1982
Organic chemicals	\$ 6,050	\$ 6,093	\$ 5,326	\$ 5,440	\$ 4,604	\$ 4,265	\$ 3,477	\$2960
Plastics and resins	3,834	4,050	3,732	3,650	1,636	1,484	1,098	766
Medicinals and pharmaceuticals	2,814	2,628	2,494	2,275	1,057	931	703	563
Inorganic chemicals	2,172	2,184	1,838	1,969	1,983	2,064	1,615	1502
Fertilizers, manufactured	2,105	1,815	1,267	1,386	1,013	1,142	997	963
Radioactive materials	1,263	1,421	1,213	1,132	1,346	1,394	952	1143
Pesticides and disinfectants	643	707	630	607	434	308	251	265
Flavors, perfumes, cosmetics, and toiletries	488	498	493	514	550	521	370	295
Pigments, paints, and varnishes	332	335	328	332	246	232	145	103
Cleaning and polishing materials	310	308	295	324	159	118	90	76
Dyeing, tanning, and coloring materials	133	158	163	162	347	358	300	213
Explosives and pyrotechnics	111	146	87	90	116	84	64	67
Miscellaneous	1,905	1,992	1,885	2,010	984	797	717	579
TOTAL	\$22,160	\$22,336	\$19,751	\$19,891	\$14,475	\$13,697	\$10,779	\$9494

^a C&EN estimates. Source: Bureau of the Census

As U.S. imports of oil resume their decline ...

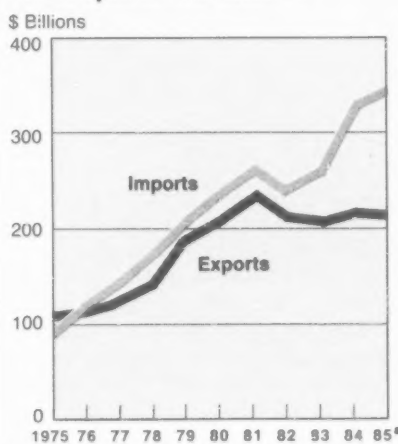


... their cost drops substantially



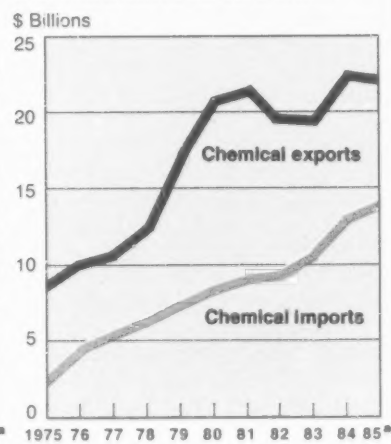
^a All petroleum products. ^b C&EN estimate. Source: Bureau of the Census

Gap between all U.S. exports and imports widens ...



^a C&EN estimates. Source: Bureau of the Census

... while surplus in chemical trade continues to shrink



ing, exports this year probably will be down 1.0% or so, to about \$215 billion.

U.S. chemical trade fortunes aren't any better. Imports are up, and exports are marginally down. The big difference is that the U.S. chemical trade balance is still in the black. The surplus, however, has been shrinking and it will shrink again this year.

World chemical trade is increasing this year at a faster clip than overall trade. It is likely to be up about 8% to a record \$160 billion. This is the strongest annual growth in world chemical trade since 1980.

But U.S. chemical companies didn't capitalize on the opportuni-

ty. Last year, U.S. chemical exports jumped 13% to \$22.34 billion. This year, they will dip about 1% to \$22.16 billion. That performance pushes down the U.S. share of world chemical trade (total world chemical exports less U.S. chemical imports) from last year's 16.5% to 15.3%.

If the steam goes out of the world chemical export market next year, the U.S. chemical industry will have scant hope of pulling its market share back up. Meanwhile, if U.S. chemical companies didn't benefit from this year's strong world chemical export market, who did?

It wasn't the Japanese. Their chemical exports were nearly 3% lower than last year. Canada's chem-

Foreign Trade

ical exports increased this year, but only about 3% (on a U.S. dollar basis).

Some of the increased chemical trade volume reflects exports from new petrochemical-producing countries, such as Saudi Arabia. Other developing countries, among them Brazil and Mexico, have pushed petrochemical exports, too.

But the big winners are chemical producers in Western Europe. Chem-

ical exports from the European Economic Community, for instance, will probably be 10 to 12% higher than last year's. That's well above the average for overall world chemical exports.

A good share of chemical exports from Western Europe ended up in the U.S. Chemical imports from Western Europe are up 9% this year and have captured 48% of the U.S. chemical import market. Only four years ago, Western Europe's share was 41%.

Indicative of the new kids on the chemical trade block: U.S. chemical imports from the Middle East are likely to increase 64% this year. Admittedly, though, that's from a very small base. Despite the strong gain, those imports will amount to only \$246 million this year.

In fact, virtually every chemical-exporting area managed to sell more chemicals to the U.S. in 1985. U.S. chemical companies, meanwhile, found their overseas markets drying up. They improved sales in only two of their major foreign markets—Canada and Western Europe.

The gain in U.S. chemical imports coupled with the slight shrinkage in exports has pulled the chemical industry's cherished trade surplus down below \$8 billion for the first time since 1978. And, at an estimated \$7.69 billion, it is a worrisome 37% below its record \$12.1 billion set in 1980.

In the past five years, U.S. chemical exports have grown only 7%. That's not average annual growth—it's for the entire five years. Chemical imports, meanwhile, have grown 10 times as fast—about 68%.

The reasons, by now, are well documented. The muscular dollar, faster economic growth at home than in other countries, and debt-ridden developing nations are some of the major ones. But there really are only two major trouble spots. Among the industrialized areas, it is Western Europe. Latin America is the Achilles heel among developing areas.

Since 1980, the U.S. chemical trade balance with Western Europe has shifted from a strong surplus to a deficit this year. The five-year swing amounts to \$2.7 billion. The U.S. still has a trade surplus with Latin America, but the surplus is \$1.9 billion thinner than it was five years ago.

If it were not for those two areas, the U.S. chemical trade situation would not be so bleak. As it stands now, however, U.S. chemical trade has deficits in four of its major product classifications: radioactive materials; dyeing, tanning, and coloring materials; flavors, perfumes, cosmetics, and toiletries; and explosives and pyrotechnics.

Of them, the dyes and flavors categories are by far the most significant. U.S. dyes trade has slipped from a lowly \$9 million deficit in 1980 to a \$214 million deficit this year. The U.S. now imports 2.6 times the amount of dyes that it exports. In flavors and related products, the U.S. has gone from a \$177 million surplus five years ago to a \$62 million deficit in 1985. Little wonder that industry leaders are concerned about pending U.S. trade policy and the upcoming multilateral trade talks.

Developing countries largely account for dip in exports

\$ Millions	1985 ^a	1984
U.S. CHEMICAL EXPORTS		
Canada	\$ 2,837	\$ 2,752
Latin America	3,701	3,827
Western Europe	6,737	6,497
Eastern Europe	332	275
Japan	2,881	2,961
Australasia	753	842
Communist Asia	554	645
Middle East	399	429
Rest of Asia	3,191	3,292
Africa	443	510
Other	332	306
TOTAL	\$22,160	\$22,336

\$ Millions	1985 ^a	1984
U.S. CHEMICAL IMPORTS		
Canada	\$ 3,054	\$ 3,131
Latin America	1,274	1,208
Western Europe	6,948	6,392
Eastern Europe	304	32
Japan	1,419	1,311
Australasia	246	251
Communist Asia	159	157
Middle East	203	124
Rest of Asia	434	377
Africa	217	196
Other	217	224
TOTAL	\$14,475	\$13,697

^a C&EN estimates. Source: Bureau of the Census

Declining agricultural exports and rising manufactured imports widen U.S. trade deficit

\$ Billions	U.S. exports				U.S. imports			
	1985 ^a	1984	1983	1982	1985 ^a	1984	1983	1982
Chemicals	\$ 22.2	\$ 22.3	\$ 19.8	\$ 19.9	\$ 14.8	\$ 13.7	\$ 10.8	\$ 9.5
Machinery and transportation equipment	95.5	90.0	82.6	87.1	134.3	119.2	86.1	73.3
Other manufactured goods	29.9	30.8	30.0	32.7	92.7	88.6	66.5	61.2
Food and live animals	19.3	24.5	24.2	24.0	19.0	18.0	15.4	14.5
Beverages and tobacco	2.6	2.9	2.8	3.0	3.7	3.7	3.4	3.4
Mineral fuels, lubricants, and related materials	9.5	9.3	9.5	12.7	52.2	61.0	56.0	65.4
Crude materials (inedible) other than fuels	17.4	20.2	18.6	19.2	10.9	11.1	9.6	8.6
Animal and vegetable oils and fats	1.5	1.9	1.4	1.5	0.7	0.7	0.5	0.4
All other products	10.9	10.1	7.0	6.9	11.2	9.8	7.7	7.7
TOTAL	\$215.0^b	\$217.9^b	\$200.5^b	\$212.2^b	\$339.5	\$325.7	\$258.0	\$244.0

^a C&EN estimates. ^b Includes re-exported imports (not included in individual product categories). Source: Bureau of the Census



Growth in chemical output slows a bit, but business generally is healthy

Increasing competition in foreign and domestic markets and continuing excess capacity cloud outlook for chemicals

Dermot A. O'Sullivan, C&EN London

West European chemical companies came through 1985 in a generally good state of health. Demand for a broad spectrum of chemicals held up well, and many plants ran close to capacity.

"There is more optimism in Europe than I have seen in the five years I've been here," remarks Jim Bayne, treasurer of Brussels-based Essochem Europe. "Europeans have adjusted to the energy shocks of 1973 and 1979, and terms of trade seem finally to be working in our favor. This, coupled with a weaker dollar, declining inflation, and reduced budget deficits, may well lead governments to opt for more growth-oriented fiscal and monetary policies."

BASF chairman Hans Albers says, "BASF is in fine shape. We have finished three quarters of 1985 with good results." In much the same vein, Bayer chairman Hermann-Josef Strenger notes that business this year has turned out to be better than expected. And Wolfgang Hilger, who took over as chairman of Hoechst earlier this year, states, "There ought to be no doubt that we shall be able to present a favorable financial statement for 1985."

The optimism is borne out by the financial results of European chemical companies. BASF recorded the biggest gain in pretax profits during this year's first nine months, with a 34% rise above the year-earlier level to about \$92.3 million. Akzo increased pretax earnings 22% to \$312 million and Bayer 14% to \$940 million.

In comparison, Hoechst's 11% advance (to \$883 million) appeared modest. The principal factor that depressed its results was the weak showing of American Hoechst, its U.S. subsidiary.

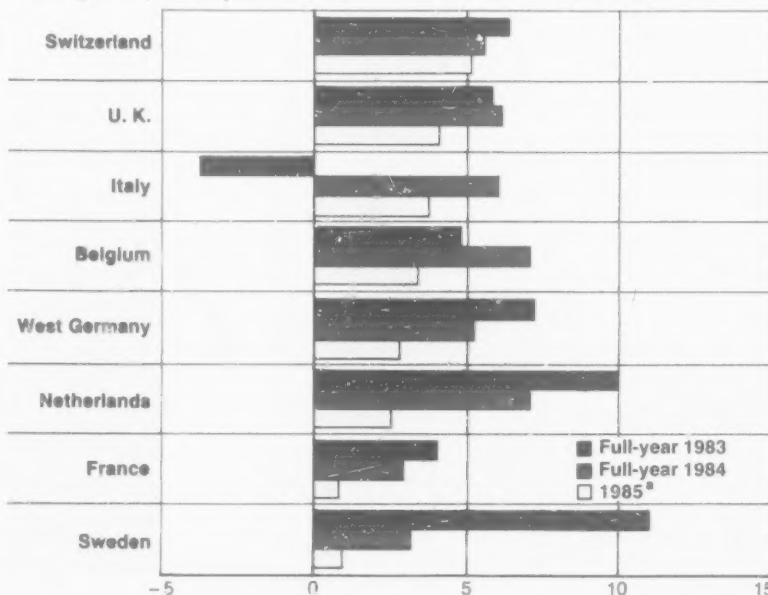
For Imperial Chemical Industries (ICI), on the other hand, earnings fell 8% from the corresponding 1984

period to \$1.09 billion. The downturn has resulted largely from the relative strength of the British pound against the West German mark and the U.S. dollar.

Currently, the pound stands at about 3.7 deutsche marks. U.K. economists argue that the pound is at least 10% overvalued when gauged against differences in economic fundamentals of the two countries, such as rates of inflation and industrial production. Such considerations, the economists say, suggest that the exchange rate of the pound should be nearer 3.3 marks. This is important, because profit margins of U.K. producers are being squeezed on a variety of petrochem-

Output of chemicals is rising more slowly this year

% change from previous year



^a 1985 data are estimates for full year for Belgium and France and for first nine months for other countries.
Sources: National chemical federations for each country

icals that in Europe are quoted in marks.

Meanwhile, the weakening of the dollar, which set in earlier this year, is being viewed with some apprehension by European chemical firms. Ironically, the revaluation of the dollar vis-à-vis the major international currencies has stemmed from demands by finance ministers of a number of countries that the U.S. government take action to stem its rise.

The dollar has gone from strength to strength in the past few years. Compared with its value in January 1982, by March this year it was up almost 74% against the French franc, 44% against the West German mark, and 70% against the Italian lira. In the case of the U.K. pound, when the dollar peaked in February it was 72% higher over the same time span. Similar increases were registered against other European currencies.

Recently, however, the dollar has weakened. Between this year's peak levels and the end of November, the dollar declined more than 24% against both the franc and the mark, 18% against the lira, and 26% against the pound.

Of course, an advantage stemming from a weaker dollar is that oil and naphtha, which are priced in dollars, are cheaper to buy in local currency terms. But that gain is offset by some decided disadvantages.

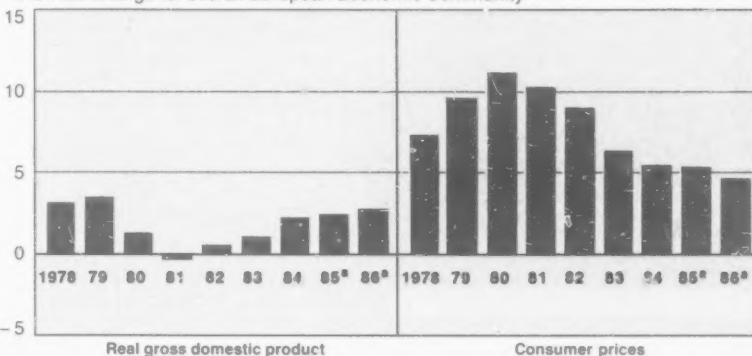
One of those is that European companies are losing the competitive edge they have enjoyed on exports to dollar trading areas. Consequently, profit margins are being whittled as exporters strive to protect their share of the market. In addition, a weaker dollar results in U.S. chemicals and other goods costing less in West European markets.

"The weakening dollar will put some pressure on the economies of Western Europe as domestic markets must absorb products that were being exported to Third World countries," admits Thomas A. Sparta, executive vice president of Dow Europe, which is heading for a record year. "However, I don't think the economies of those countries have yet peaked, so they will support continued growth for many parts of the chemical industry."

"The dollar's decline so far has

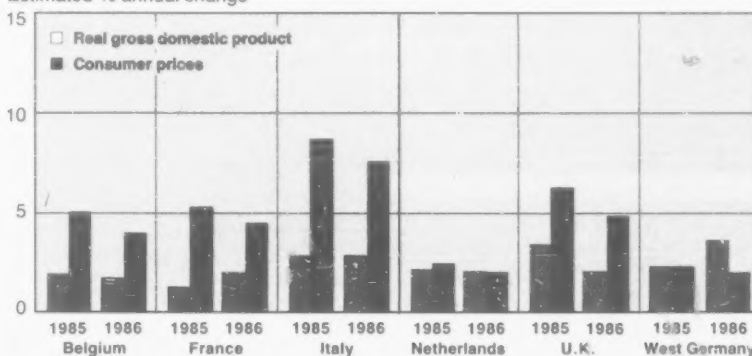
Economic growth is moderate but inflation remains low . . .

% annual change for overall European Economic Community



. . . with West Germany expected to show the best results

Estimated % annual change



* Estimates

Sources: Commission of the European Communities, Organization for Economic Cooperation & Development

not created severe changes in world supply patterns. But the situation must be monitored very carefully. Further decline could shift the competitive positions of major producing nations."

The weakening dollar has an additional effect on European companies with sizable U.S. sales. (In the case of ICI, for instance, the U.S. accounts for about a quarter of its annual sales.) Profits generated by those sales appear smaller when the dollar values are translated into the currency of the countries where those companies are headquartered. The converse also holds, of course. The European activities of U.S. companies are looking healthier than they have in the recent past.

On the broad economic front, government policies throughout Europe appear to have brought inflation further under control. For the European Economic Community as a whole, consumer prices this

year are up, on average, 5% from a year ago, the smallest rate of annual increase since 1970.

West Germany and the Netherlands show up best, with consumer prices slightly more than 2% higher than in 1984. Other EEC members, except Greece, where inflation is running at about 20%, have cut the annual increase well below the levels that existed a few years ago. Further improvements are forecast for 1986.

But concern still centers on high unemployment. Ireland, where 17% of the working population is without jobs, is the worst off. Double-digit jobless figures also show up in Belgium, France, Italy, the Netherlands, and the U.K. Throughout EEC, unemployment has climbed to the current average of 11.2% of the labor force.

The 1985 annual economic report of the Commission of the European Communities states, "The apparent

inevitability of the prospect of persistently high unemployment has led to widespread pessimism with regard to economic policy. If the relationship between growth and employment observed in the 1960s still applied, medium-term growth rates above 6% would be necessary to achieve the increase in employment (between 1 and 1.5% yearly) needed to bring down unemployment gradually but significantly. Such rates of growth are at present quite unattainable."

This year, EEC's gross domestic product will be up 2.3%, on average, from 1984. The U.K. will register the highest rate of growth (3.4%), France the lowest (1.2%). Next year, an average increase of 2.5% is forecast.

As for growth in chemical output in Western Europe, the trend is down. The biggest dip will occur in the Netherlands and Sweden. For Belgium, the 1985 increase is only half that of 1984.

However, at least one segment of the chemical industry—synthetic fibers—has gained ground this year. All the European producers are making a profit, reflecting sales that are healthier than had been forecast earlier and better utilization of capacity in the wake of major slimming moves in previous years. On average, plants are running at better than 85% of capacity, several percentage points higher than in 1984.

Polyester fiber has outpaced the rest, with this year's output likely to be 1.91 billion lb, 12% more than in 1983. Production of acrylic fiber will be 1.86 billion lb, up 11%; that for polyamides 1.44 billion lb, up 9%.

Western Europe has been the target of sizable quantities of imported acrylic fiber, much of it from plants in Turkey. This year, imports will total about 59 million lb, down from 77 million lb last year. The decline follows antidumping moves taken recently, which should lead to a further reduction in imports. Meanwhile, France's Rhône-Poulenc has dropped out of acrylic fiber production with the closure of its 55 million lb-a-year plant, deemed too small to be operated economically.

The dispute between Akzo of the Netherlands and Du Pont over pat-

ent claims involved in production of aromatic polyamide (aramid) fibers continues. Du Pont contends that Akzo's route to the high-strength fiber infringes its patents. The charge has been upheld by the U.S. International Trade Commission, which has issued an exclusion order that will prevent Akzo from exporting its aramid fiber, trade-named Twaron, or products made of it, to the U.S. unless licensed by Du Pont. Akzo, on the other hand, maintains that the ruling does not apply to goods incorporating Twaron that its customers make.

Nevertheless, both firms are going ahead with plans to make the fiber in Europe. Akzo's fibers subsidiary, Enka, partnered with Northern Development Co., an arm of the Netherlands government, is due to start production shortly in a plant with an annual capacity of 11 million lb. Du Pont has chosen Maydown, in Northern Ireland, as the site for its 15.4 million lb-a-year Kevlar aramid fiber plant, due on stream in 1987.

In another fibers-related move, Du Pont is investing \$120 million in a plant in Luxembourg to make Tyvek spun-bonded high-density polyethylene. It will have an initial capacity of 44 million lb annually when completed in 1988. Tyvek nonwovens are used for making a variety of items, such as disposable garments and hospital sheeting, waterproof envelopes, and sterile packaging.

Business for another segment of the European chemical industry—fertilizers—also has been fairly good this year, with two exceptions: urea and phosphate-based compound fertilizers. Urea prices have fallen about 50% since January, influenced by reduced purchases by China and India, and by increased availability—especially from Eastern Europe and from new producers in Indonesia.

"We foresee fierce competition in urea, and rather depressed prices for all other fertilizers exported overseas," contend managers of the business at DSM in the Netherlands. "Urea prices will not recover quickly, but a gradual improvement in 1986 is expected. In Europe itself, there will be some pressure from

outside, which might hamper a strengthening of prices."

Fertilizer sales outside Western Europe are priced in dollars. Here again, a lower dollar results in lower profitability for European export sales, and imports into Europe tend to increase. Raw material prices, too, are influenced by the dollar exchange rate.

One of the uncertainties ahead is the increasing problem of obtaining foreign currency exchange permits for fertilizer imports by developing countries. Another is the outlook for farm income, both in Europe and the U.S.

Much will depend on the level of use next spring, and on the prices guaranteed farmers in EEC. Normalization of fertilizer use in China and increased purchases by the Soviet Union would help the situation. However, "These issues are wholly or partly dictated by politics," DSM managers note.

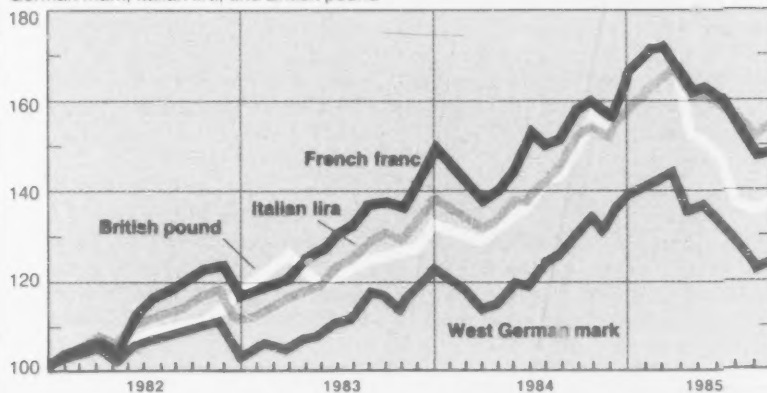
Moves already are under way to improve profitability of the West European companies' operations. For instance, DSM's fertilizer division is putting in a major nitric acid facility in the Netherlands. Due on stream in 1987, it will be capable of making more than 1.47 million lb daily, with resulting economies of scale. Earlier this year, DSM started up a 968 million lb-a-year ammonia plant designed to use 20% less energy than older ones. ICI also is replacing two ammonia units in the U.K. with plants using its own energy-efficient process. Their combined annual capacity of 660 million lb will match that of existing plants being scrapped.

Restructuring moves also have taken place this year within the fertilizer industry. Most notable was Norsk Hydro's acquisition of Ruhrstickstoff, fertilizer arm of Veba, a West German oil and chemicals concern. Norsk also has agreed to take over a major stake in Cofaz, France's second largest fertilizer producer.

Western Europe's petrochemicals producers have experienced a mixed year. Business held up fairly well in the second and third quarters, but was weak in the opening and closing months. The consensus is that 1985's profits won't be so good as 1984's.

The dollar tumbles from last winter's heights

Relative value of U.S. dollar vs. French franc, West German mark, Italian lira, and British pound^a



^a January 1983 = 100. Note: During January 1982, the average value of the U.S. dollar was 5.825 francs, 2.29 marks, 1227 lira, and 0.53 pound. Source: International Monetary Fund.

"There has been a slide in prices for certain commodities in the fourth quarter," notes Heinz Klaar, head of lower olefins and derivatives operations at Shell Chemical International Trading Co. "We are on the downside slope of a hill. And 1986 undoubtedly will be more competitive. On the other hand, if demand continues worldwide at the level that it is right now, I could be cautiously optimistic. But 1986 won't match 1984 either."

Ethylene went through an unusual period in Europe around midyear. Long in oversupply because of excess cracker capacity, four units were put out of production as a result of accidents. All told, output equivalent to 3.36 billion lb a year was knocked out of commission. Two of the units, those belonging to DSM in the Netherlands and Statoil of Norway, are back on stream. There's some question as to whether the 441 million lb West German unit of Rheinische Olefinwerke, a joint venture between BASF and Shell, is to restart. However, EniChem expects to restart its 1.32 billion lb plant in Italy before mid-1986.

Because of the shutdowns, ethylene availability became tight almost overnight. Not surprisingly, prices went up and for some weeks ethylene had to be shipped into Europe by tanker for the first time. Since the return of supply to near normality, prices have drifted down again, aided by the cheaper cost of naphtha

and gas oil, quoted in dollars, in local currency terms.

A few weeks ago, Europe saw the startup of an ethane-based cracker at Mossmorran, Scotland. Owned and operated by Essochem, Shell Chemicals U.K. funded half the \$580 million cost and takes half the 1.1 billion lb-a-year output as feedstock for its petrochemical units at Carrington, near Manchester. Essochem, meanwhile, ships its share to continental Europe. The European branch of Exxon Chemical now will dismantle its 990 million lb cracker at Cologne, West Germany.

Western Europe's ethylene consumption this year will be about 27.5 billion lb, marginally more than last year. Cracker capacity stands at about 31 billion lb. If, as some fear, ethylene derivatives and ethylene itself flood Europe in increasing quantities from plants in Saudi Arabia, more cracker shutdowns will be needed, and that will be when the really tough decisions will have to be made.

Because of the phaseout of naphtha and gas oil crackers, Euro-

pean availability of propylene, co-produced with ethylene, is on the decline. But demand is rising, mainly as a result of the building of new polypropylene units. Existing polypropylene plants are running flat out. And most European producers are expanding. Some propylene can be recovered from refinery streams, but at higher cost. As a result, increasing quantities are being imported into Europe, mainly from the U.S.

Ethylene isn't the only petrochemical in oversupply in Western Europe. Downstream products are, too. Herman Scopes, a director of ICI's petrochemicals and plastics division, notes that overcapacity of polystyrene stands at 23%, that of polyethylenes at 25%, and of polyvinyl chloride at 30%. For ethylene oxide, he pegs the overcapacity level at about 32%.

"A bold restructuring and reduction of capacity for the standard plastics must be at the center of our endeavors," says Manfred Roh, president of the Association of Plastics Manufacturers in Europe. "Only in good business years are these steps thinkable and easy to carry out. The present time encourages voluntary action without state intervention and help."

"Overcapacity should be dismantled on the individual initiative of the firms involved, according to the economic rules of the market. However, to lighten the adjustment process for our industry, we will advocate trade policy measures within the framework of the General Agreement on Tariffs & Trade protection clauses."

David F. Oxley, associate director at Chem Systems International in London, who keeps close tabs on worldwide polymer markets and trade patterns, foresees growth rates for West European consumption of the commodity plastics slowing between 1985 and 1995 from their present level. Even growth in demand for linear low-density polyethylene, now advancing about 33% annually, will slacken to about 11% a year during the next 10 years.

Much to the relief of the West Europeans, the amount of Saudi Arabian petrochemicals entering their domestic markets this year hasn't

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been so significant as had been feared. Nonetheless, the likelihood of imports from Saudi Arabia creates a certain amount of nervousness throughout the marketplace, even though the volume penetration isn't large.

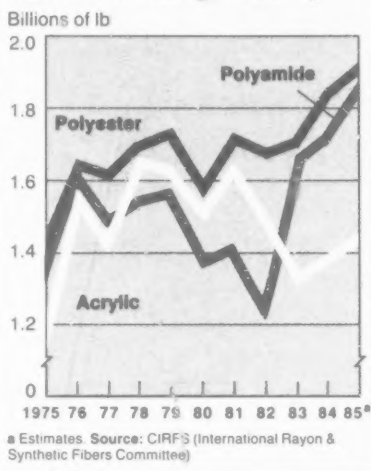
"During most of 1985, when polyethylene was in short supply in Western Europe, imports from Saudi Arabia helped meet customer requirements," observes Karl L. Boehmer, plastics vice president at Essochem Europe. "With the business turning down later in the year, competition from Saudi material has become more noticeable."

The recent significant price erosion for conventional low-density polyethylene can hardly be blamed on imports of relatively small volumes of Saudi linear low-density polyethylene, he adds. "Much of the Saudi polyethylene is moving to local and Far East markets and therefore has mainly an effect on exports by West European producers."

Although there undoubtedly is room for more restructuring along the lines advocated by APME's Manfred Roh, this year has seen some major moves by leading chemical makers throughout Europe. ICI, for instance, has bowed out of European low-density polyethylene production with its decision to sell its remaining facility, at Fos in the south of France, to Shell Chimie. (ICI, the pioneer in the development of low-density polyethylene 50 years ago, still makes the polymer in Argentina, Australia, Canada, India, and South Africa.)

Shell is setting up a new company, Société du Polyéthylène de Fos, to operate the 220 million lb-a-year unit, which has been receiving eth-

European fiber production has been rising recently



ylene feedstock from Shell's neighboring 770 million lb-a-year cracker. Meanwhile, Shell will continue to make low-density polyethylene in a 230 million lb-a-year plant nearby.

This year, too, ICI handed over its 154 million lb low-density polyethylene operation at Rozenburg, the Netherlands, to France's Atochem in exchange for Atochem's units making ethylene oxide derivatives. The Rozenburg plant has been closed down. (Atochem already has capacity for making 781 million lb of the polymer in France.) The products ICI acquired extend its range of ethylene oxide-based chemicals.

There also is a strong likelihood that Bayer will assign its 50% share in Erdöl Chemie's 660 million lb-a-year low-density polyethylene plant in Cologne, West Germany, to BP Chemicals, its partner in the operation. Bayer's Strenger commented

recently that Bayer has no direct use for the plant's output. However, Bayer still intends to keep its half-interest in the Erdöl Chemie 836 million lb-a-year (of ethylene) cracker, which provides Bayer with feedstock for fibers and synthetic rubber.

If the move materializes, BP Chemicals will become West Europe's second largest producer of low-density polyethylene after Italy's EniChem. BP Chemicals' present plants in Belgium and the U.K. have a combined annual capacity of 627 million lb.

EniChem and ICI are studying the possibility of collaborating in the production of vinyl chloride and polyvinyl chloride. The companies say the aim is to make maximum use of their most efficient assets and to pool their technical and commercial expertise, "thereby significantly improving the cost structure of the businesses."

The two companies are major producers of the chemicals. In the case of vinyl chloride, EniChem's capacity amounts to 1.86 billion lb; that of ICI is 1.45 billion lb. Likewise, EniChem has annual polyvinyl chloride capacity of 1.70 billion lb and ICI has 1.25 billion lb. Between them, the British and Italian firms share nearly 20% of Western Europe's market for polyvinyl chloride.

Another move involves BASF's purchase of Monsanto's operations at Seal Sands, England. The plants are designed to make 400 million lb of acrylonitrile, 198 million lb of adiponitrile, and 198 million lb of hexamethylene diamine yearly. The acquisition fits well BASF's needs for intermediates for its fibers and plastics operations. □

Growth is sluggish for thermoplastics in Western Europe

Consumption, millions of lb	1980	1982	1984	1985*	1990*	1995*	Estimated annual change	
							1980-90	1985-95
Linear low-density polyethylene	132	297	671	990	2,200	2,850	32%	11%
Polypropylene	2,805	3,125	4,048	4,290	5,060	5,720	6	3
Acrylonitrile-butadiene-styrene	682	704	847	825	979	1,089	4	3
Polystyrene	3,619	3,476	3,751	3,740	4,224	4,554	2	2
Polyvinyl chloride	8,195	7,700	8,371	8,382	9,152	9,900	1	2
High-density polyethylene	3,135	3,080	3,729	3,916	4,070	4,488	3	1
Low-density polyethylene	8,327	7,832	8,206	8,184	7,040	6,600	-2	-2
TOTAL	26,895	26,214	29,623	30,327	32,725	35,211	2	2

* Estimates. Source: Chem Systems International



Strong this year, chemical business may weaken during next 12 months

Chemical companies are being crimped by strong yen abroad and by slower economic growth in their domestic markets

Earl V. Anderson, C&EN New York

Although not the best of years for Japanese chemical companies, 1985 certainly was much better than expected when the year started.

For many of Japan's top chemical companies, fiscal 1985 will go down as a very good year indeed. When it ends (for most firms that will be March 1986), quite a few will chalk up record or near-record sales and earnings. Profit margins will be well above those of the past few years.

But fiscal 1985 is a paradox for the Japanese chemical industry. The first half was robust. During the second half, however, chemical companies have found it increasingly difficult to maintain sales and even more difficult to keep profits from sagging.

Unfortunate for the industry, the second half is more likely to be the harbinger of things to come in 1986. A number of economic screws are turning in Japan that seem certain to pinch the chemical business next year.

Perhaps most painful is the much stronger yen. At the start of the year, the yen traded at 250 to 260 to the U.S. dollar. As recently as August, it was at 237. And by the first of this month, a dollar was worth only 201 yen.

This much stronger yen is putting pressure on Japanese chemical companies in a way that is all too familiar to U.S. chemical companies

that have had to cope with a strong dollar during the past few years, a pressure they will continue to feel next year.

Because of the stronger yen, chemical exports have become less competitive in foreign markets, while imports have become more competitive in the Japanese market. Already hurting competitively in international markets, Japanese chemical companies don't need the additional pressure of a stronger yen.

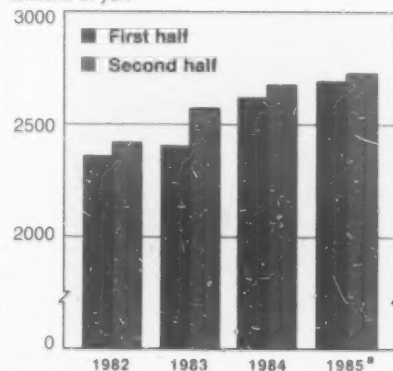
Both chemical exports and imports will be down this year. Exports have been hit particularly by a sharp drop in synthetic resin sales to Southeast Asia, Japan's most important chemical export market. Lower shipments of organic chemicals from the U.S. contributed to the decline in chemical imports.

Total chemical exports will decrease 2.6% to about \$7.43 billion, but chemical imports will shrink only 1.2% to \$8.25 billion. As a re-

Japanese petrochemical firms gain stronger financial footing

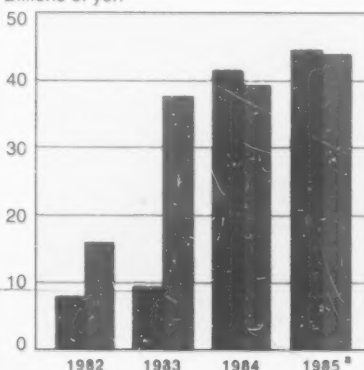
Although sales are little changed . . .

Billions of yen



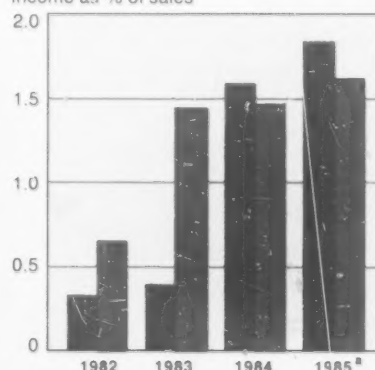
. . . profits are higher this year . . .

Billions of yen



. . . and profit margins have firmed

Income as % of sales



* Data for second half of 1985 are estimated. Note: Data for fiscal years ending March 31. Based on results of 10 leading Japanese petrochemical companies: Mitsubishi Chemical Industries, Sumitomo Chemical, Asahi Chemical Industry, Toray Industries, Mitsui Toatsu Chemicals, Teijin, Showa Denko, Mitsubishi Petrochemical, Daiippon Ink & Chemicals, and Sekisui Chemical. Source: Toyo Keizai Shinposha

sult, Japan's chemical trade balance, unlike its overall trade situation, will show an \$825 million deficit. For the third successive year, Japan has suffered a deficit in its chemical trade.

More ominously, 1985 will be the first year in 20 years that Japan has had a deficit in its petrochemical trade. According to a survey conducted jointly by the Ministry of International Trade & Industry (MITI) and the Japan Petrochemical Industry Association (JPCIA), petrochemical exports through the first nine months of 1985 were 1.2 million metric tons, and petrochemical imports hit 2.0 million metric tons.

By far, the leading imported petrochemical is methanol. Almost 715,000 metric tons were imported during the first nine months, with much of it coming from new plants in Saudi Arabia. Now the Saudis are looking toward Japan as an outlet for even more methanol from their third methanol unit.

Methanol production in Japan declined steadily between 1979 and 1982 to 625,000 metric tons. Since then, it has plummeted and probably will be no more than 260,000 metric tons this year.

Other major petrochemical imports include ethylene dichloride, styrene, ethylene glycol, acrylonitrile, and polyvinyl chloride. These products, along with methanol, accounted for almost 80% of Japan's petrochemical imports during 1985's first nine months.

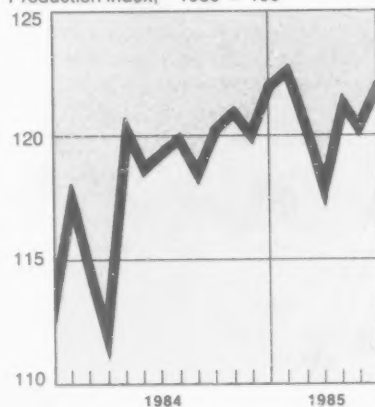
Japan's petrochemical import situation is serious. And there's little possibility that it will get better. As a result, MITI has been talking to industry leaders about eliminating the preferential tariffs that Japan gives to petrochemical imports from developing countries.

The obvious target of such a move is Saudi Arabia, which the Japanese feel is so cost-competitive that it doesn't need preferential tariffs. Eliminating preferential tariffs on petrochemicals, however, might not sit well with Japan's trading partners, particularly those developing countries that benefit from them. Japan is, after all, under heavy pressure to make it easier, not more difficult, for foreign products to enter its home market.

Little growth for chemical output in past two years

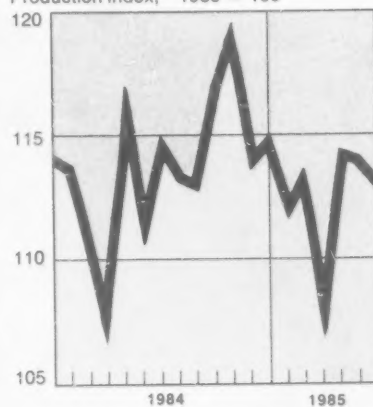
All chemicals

Production index, ^a 1980 = 100



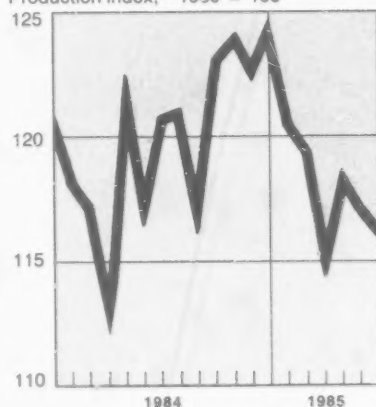
Petrochemicals

Production index, ^a 1980 = 100



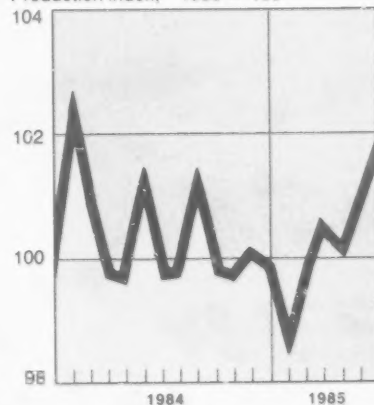
Plastics

Production index, ^a 1980 = 100



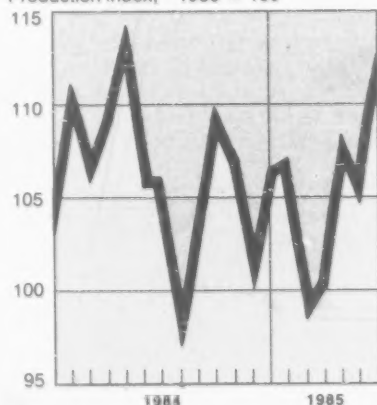
Synthetic fibers

Production index, ^a 1980 = 100



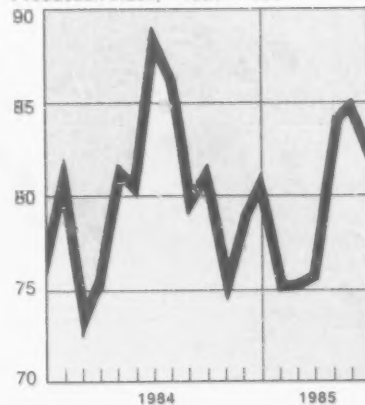
Synthetic rubber

Production index, ^a 1980 = 100



Fertilizers

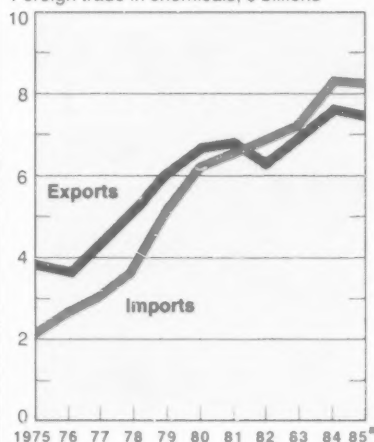
Production index, ^a 1980 = 100



^a Seasonally adjusted. Source: Ministry of International Trade & Industry

Trade deficit widens as both exports and imports dip

Foreign trade in chemicals, \$ billions



a C&EN estimates.
Source: Ministry of International Trade & Industry

In one small way, the Japanese petrochemical industry will benefit from a strong yen. Increasingly, basic petrochemical producers have been importing naphtha for feedstock. During the first half of fiscal

1985, petrochemical naphtha imports were up 18% from last year's similar period.

Prices, however, barely nudged upward. A strong yen, then, can mean less expensive imported feedstock for the petrochemical industry. But this lower cost falls far short of offsetting the trade disadvantage of the strong yen.

In fact, some chemical executives believe that cheaper imported naphtha is a bane, not a blessing. Chemical companies have been trying to push through some much-needed price increases, but customers are hanging tough against them. The main reason for their resistance is the stronger yen, which makes imports less expensive. But lower naphtha prices are another reason some customers are seeking lower, not higher, prices on chemicals.

What success Japanese chemical firms have had in ringing up sales and profit gains this year has sprung from their own domestic market. But the Japanese economy isn't expected to be so strong in fiscal 1986 as it has been this year.

Japan's Economic Planning Agency estimates next year's economic growth will be just over 4%, slightly lower than this year's estimated 4.6%. But any decrease in the economic growth, coupled with the yen-actuated trade problems, concerns Japanese chemical leaders.

One reason for the anticipated lower growth rate is a slowdown in private capital spending, which has been a major driving force behind this year's growth. The slowdown already is evident in the chemical industry. Chemical plant and equipment expenditures during the first half of fiscal 1985 were up 33% over last year. During the second half, the increase will be only about 13%.

Little wonder, then, that Japanese chemical companies are furiously pursuing projects they hope will lead to new, higher-value-added products. Biotechnology is a buzzword in Japan, with research spending on it up 50% this year. Other areas that the Japanese consider promising include high-performance resins, composites, specialty chemicals, and ceramics. □

Production is running moderately ahead of last year for most major chemicals

Thousands of metric tons unless otherwise indicated	1984	Seven months 1985	1984	% change
INORGANIC CHEMICALS				
Ammonia	2029	1127	1147	-2%
Ammonium chloride	387	225	238	-6
Ammonium sulfate	1829	1082	1059	2
Calcium carbide	478	282	302	-7
Calcium superphosphate	559	329	335	-2
Carbon black	602	368	351	5
Chlorine, liquid	897	552	516	7
Hydrochloric acid	521	319	290	10
Nitrogen ^a	5896	3642	3390	7
Oxygen ^a	7216	4317	4115	5
Sodium carbonate	1036	621	608	2
Sodium hydroxide	3085	1807	1764	2
Sodium silicate	596	335	342	-2
Sulfuric acid	6458	3897	3733	4
Titanium dioxide	205	127	118	8
ORGANIC CHEMICALS				
Acetaldehyde	297	157	164	-4
Acetic acid	350	191	189	1
Acetone	346	134	138	-3
Acrylonitrile	523	311	297	5
Benzene ^b	2013	1172	1140	3
Butadiene	657	364	356	2
Butanol	243	142	137	4
Caprolactam	436	267	250	7

Thousands of metric tons unless otherwise indicated	1984	Seven months 1985	1984	% change
Other Organic Chemicals				
Cyclohexane	492	311	292	7
Diethyl phthalate	249	141	148	-5
Ethylene	4384	2434	2535	-4
Ethylene dichloride	1939	1105	1123	-2
Ethylene glycol	429	255	234	9
Ethylene oxide	533	323	298	8
Methanol	280	151	171	-12
Octanol	246	126	134	-6
Phenol	272	146	155	-6
Phthalic anhydride ^b	156	95	90	6
Propylene	2981	1685	1683	0
Propylene glycol	205	121	119	2
Styrene	1421	811	786	3
Terephthalic acid	745	466	419	11
Toluene	784	446	442	1
Toluene diisocyanate	76	46	42	10
Urea	1120	614	606	1
Xylene	1401	841	798	5
PLASTICS				
Phenolic resins	334	196	192	2
Polyethylene	2251	1154	1323	-13
Polypropylene	1271	738	711	4
Polystyrene	1503	922	851	8
Polyvinyl chloride	1504	883	874	1
SYNTHETIC RUBBER				
	1160	679	685	-1

a Millions of cubic meters. b Petroleum-based product only. Source: Ministry of International Trade & Industry



Profits remain elusive for major chemical producers

Slower economic growth may hurt chemical operations, but lower feedstock costs will be a boon for petrochemicals

Earl V. Anderson, C&EN New York

As 1985 draws to a close, Canadian chemical companies are enjoying the third successive year of Canada's strong economic growth. But they might have enjoyed it more.

Despite production gains—in some cases significant gains—and sales increases in some product areas, satisfactory profits have been hard to come by. Too often this year, higher production has resulted from capacity increases rather than strong demand. And customer resistance has kept a lid on price increases.

Whether Canadian chemical companies will be able to improve their profits next year is difficult to predict. Working against higher profits will be an all-too-likely slowdown in Canadian economic growth. Working for them will be new energy policies that could lower feedstock costs for basic petrochemicals producers.

According to the Conference Board of Canada (CBC), the Canadian economy is in for a substantial deceleration. The board pegs growth in real gross national product at 4.5% this year, but sees it sliding to about 2.5% in 1986. What's more, CBC says that growth will continue to slow, with the increase in real GNP growth hovering near 1.5% per year from 1988 to 1990.

Faced with those economic prospects, shoring up profit margins will

be no small task for Canadian chemical companies. Much will depend upon how much fat they can trim out of their costs. They already have trimmed a lot, but the new oil and natural gas pricing policies could help. Much, too, will depend upon the fortunes of some of the major chemical-consuming industries in Canada.

It's no secret that some of these industries are in trouble. James D. Hembree, president and chief executive officer of Dow Chemical Canada, points to the pulp and paper industry as one. He quotes Bruce I. Howe, president of B. C. Resources Investment Corp., as saying, "We Canadians are not the world's best hewers of wood any more . . . Things have changed and they have changed generally for the worse."

The basic problem in pulp and paper, says Hembree, is that the industry isn't generating enough profits to sustain growth. Although its profits did start to make a comeback last year, the industry had only a miserly 2.2% return on sales. Mean-

while, the heavily export-oriented pulp and paper industry faces worldwide overcapacity, which means tough sledding in its foreign markets probably right through next year. The Canadian share of the all-important U.S. newsprint market, for instance, is now less than 60%—far less than its traditional 75% share.

Other market sore spots for Canadian chemical companies are the textile and the metal-mining industries. Canada's textile industry has been hit hard by imports, "perhaps to the point of threatening its survival," says Hembree.

The labor-intensive textile industry has lost a significant number of jobs, first to imports from Japan, now from South Korea and Taiwan. Soon, perhaps, it will lose more to even cheaper imports from China, Thailand, and Indonesia. Hembree says the Canadian textile industry is surviving only because of government support through tariffs and quotas.

The metal-mining industry, meanwhile, has emerged from the reces-

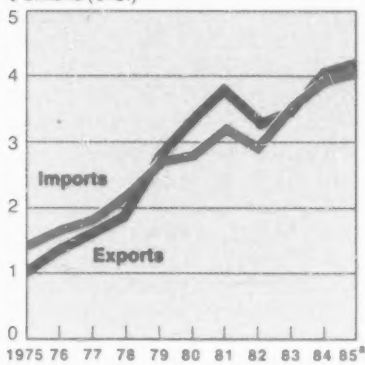
Output surges for ethylene, is little changed for inorganics

Thousands of metric tons	1985*	1984	1983	1982	1981	1980
Ammonia	3520	3493	2888	2509	2654	2555
Ammonium nitrate	1040	969	934	1018	1212	873
Ammonium phosphate	1320	1383	1259	888	1355	1466
Benzene	665	557	580	504	571	604
Chlorine	1410	1424	1385	1233	1292	1303
Ethylene	1700	1464	1196	1013	1330	1184
Hydrochloric acid, 100%	160	161	170	135	186	177
Phosphoric acid, 100%	635	691	656	503	744	808
Polyethylene	940	755	623	571	633	641
Polyvinyl chloride	280	252	243	194	222	190
Propylene	630	665	715	618	671	590
Sodium chlorate	330	313	294	264	255	245
Sodium hydroxide	1570	1575	1528	1367	1458	1459
Sulfuric acid	3885	4053	3686	3131	4117	4295
Urea	2000	2110	1445	1231	1303	1274

* C&EN estimates. Source: Statistics Canada

Chemical exports hold slightly above imports

Foreign trade in chemicals,
\$ billions (U.S.)



a C&EN estimates. Source: Statistics Canada

sion but is still sick. What recovery there has been is due only to the more "glamorous" metals, such as gold.

As a result of some anemic markets at home and fiercely competitive pricing in their export markets, many Canadian chemical companies are feeling a profit pinch. Du Pont Canada, for instance, had marginally higher sales through the first nine months of the year, but net earnings from operations slumped 62%.

The company notes that, although sales volumes are higher, "intensely competitive conditions in both domestic and export markets [are depressing] prices." That explana-

tion rings true for other Canadian chemical companies, as well.

For the first three quarters, Union Carbide Canada suffered a \$4.9 million loss on sales of \$348 million. That, of course, doesn't include a \$70 million extraordinary charge related to the company's decision to divest its polyethylene plant in Moore Township, Ont. Carbide Canada chairman W. Norman Kissick blames a severe cost-price squeeze in polyethylene for the poor operating results.

Certainly not all Canadian chemical companies are losing money and not all chemical markets are in the doldrums. A significant boost in housing starts has given a lift to construction materials. Industrial fibers and plastics markets also have been strong.

The entire transportation industry, not just cars and trucks, continues to be a lucrative outlet for chemical industry products. And Dow's Hembree pegs the food processing and electrical products industries as promising growth markets for chemicals.

Meanwhile, Canada's new pricing policies for oil and natural gas should help ease the cost-price squeeze by making feedstock prices more competitive. Relief will be felt first by the basic petrochemicals producers, but it should also filter downstream.

The so-called "western accord,"

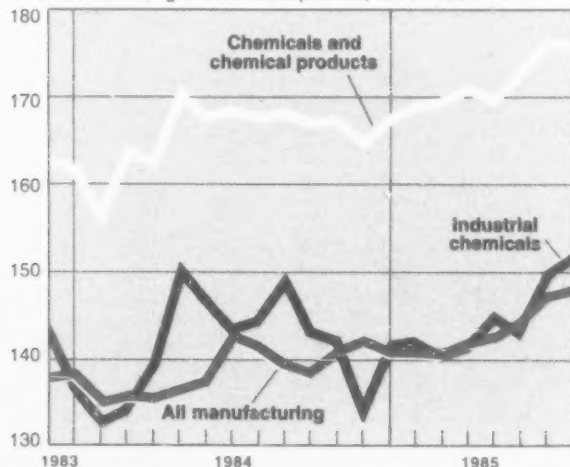
signed this spring by the federal government and three western oil-producing provinces, moves previously regulated oil toward "market responsive" pricing. By also removing some costly "up-front" taxes and other charges, it is certain to reduce the cost of oil-based petrochemical feedstocks. How much of a reduction is difficult to say, but petrochemical industry leaders can't help but be pleased with the accord. It follows closely the recommendations made in an industry task force report more than a year ago.

More recently, on Nov. 1, Energy Minister Pat Carney announced a program to deregulate Canadian natural gas markets. The program calls for a one-year transition period. During this time, producers, shippers, and distributors will renegotiate contracts, with the new prices becoming effective next November. If negotiators can't agree by then, prices will be arbitrated.

One thing is certain. Deregulated natural gas prices will be a blessing for chemical plants in the central and eastern provinces. The new natural gas policy will allow consumers to buy gas at negotiated prices. Then, they can either pay transportation costs from, presumably, Alberta to their plant or sell the gas to transporters, and later buy it back. Either way, petrochemical producers should benefit. □

Chemical output edges higher this year . . .

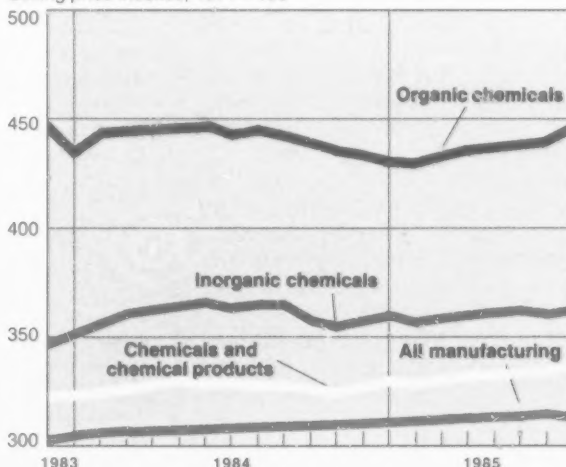
Volume indexes, ^a gross domestic product, 1971 = 100



a Seasonally adjusted. Source: Statistics Canada

. . . but chemical prices hold steady

Selling price indexes, 1971 = 100





With five big chemical plants on stream this year, plans for further petrochemical investment now are being laid

Dermot A. O'Sullivan, C&EN London

When chemical businessmen talk about the competitive threat of chemicals from the Middle East, they are thinking mostly about Saudi Arabia. For that is where the Middle East's largest and most diverse petrochemical operations are centered.

SABIC (Saudi Basic Industries Corp.) is the focal point of Saudi Arabia's petrochemical activities. Since it was set up in 1976, SABIC has completed its plants on schedule and within budget. The achievement is remarkable, considering that a basic infrastructure had to be put in place to service the operations, and that hardware, technology, and skilled labor had to be brought into the country from elsewhere.

This year alone, five major SABIC petrochemical complexes started up:

- Al-Jubail Petrochemical Co., a partnership with Exxon Chemical for making linear low-density polyethylene (572 million lb annual capacity).
- Arabian Petrochemical Co., owned 100% by SABIC, making ethylene (1.1 billion lb).
- Eastern Petrochemical Co.,

owned jointly with a Japanese consortium led by Mitsubishi, making ethylene glycol (660 million lb) and linear low-density polyethylene (286 million lb).

- Saudi Yanbu Petrochemical Co., a partnership owned jointly with Mobil Chemical, making ethylene (1 billion lb), ethylene glycol (484 million lb), high-density polyethylene (200 million lb), and linear low-density polyethylene (451 million lb).

- Saudi Petrochemical Co., a joint venture with Shell Oil, making caustic soda (829 million lb), ethanol (618 million lb), ethylene (1.44 billion lb), ethylene dichloride (999 million lb), and styrene (649 million lb).

These plants join units that came on stream in 1983 and 1984 and that have a combined annual capacity of 2.75 billion lb of methanol and 1.1 billion lb of urea. But they are not the end. Now nearing completion are units with annual capacities for 660 million lb of vinyl chloride and 440 million lb of polyvinyl chloride. These are owned by National Plastic Co., in which South Korea's Lucky Group has a 15% interest with SABIC. They are scheduled for 1986 startup.

Further off, in 1988, a complex making butadiene, butene-1, and methyl *tert*-butyl ether will be ready. This plant is being built by Saudi European Petrochemical Co., jointly owned by SABIC with Apicorp, an Arab investment corporation, Italy's EniChem, and Finland's Neste. It is designed to produce 275 million lb of butadiene, 176 million lb of butene-1, and 1.1 billion lb of MTBE yearly. Also in 1988, National Chemical Fertilizer Co.'s 1.1 billion lb-a-year ammonia operation is slated for completion.

Saudi Arabia makes its presence felt as a petrochemical producer

Additional products that SABIC now is considering include acetic acid, propylene, polypropylene, and synthetic rubber, notes Ibrahim A. Salamah, the company's managing director. And, Salamah points out, "If we need another cracker, we will go for it, although our first priority will be to develop existing crackers."

Discussions that could lead to polystyrene production are in the final stages. Being considered is capacity for 176 million lb of high-impact and general-purpose polystyrene and 44 million lb of expandable material annually. A facility for producing these products could be on stream by early 1988, costing upward to \$70 million.

According to Salamah, SABIC's sales during the first three quarters of this year were \$274 million and its net profit was \$22 million. SABIC Marketing Services Ltd. now has offices in Hong Kong and London. Arrangements are being made to open a sales office in the U.S., possibly by early next year. "We are late with this," Salamah admits. "We already are selling ethanol and polyethylene in the U.S. We have to be in all the major markets."

Action by the Commission of the European Communities to impose the standard 13.4% import tariff on Saudi chemicals coming into the European Economic Community is a source of friction between Europe and the Saudi government. The duty now applies to methanol and polyethylene and also might go on to ethylene glycol. SABIC management argues that its products should be allowed into EEC duty-free under provision of the General Agreement on Tariffs & Trade, because Saudi Arabia still is classed as a developing country. □



Soviet Union sets ambitious goals for next 15 years

Chemical industry has a key role in plans to double overall industrial production between now and the year 2000

Richard J. Seltzer, C&EN Washington

The Soviet Union must undertake a "second revolution"—this time of its economy and industry. It must double national income and industrial production by the year 2000. And it must carry out comprehensive "chemicalization of the national economy" by the end of the century.

These ambitious goals—what he calls an "historic transformation"—have been set by the new Soviet leader, Mikhail S. Gorbachev, since taking office last March. Adoption of the goals as official targets—for 1986, for the 12th Five-Year Plan (1986-90), and for the year 2000—will be completed at a Communist Party Congress (held every five years) that will convene on Feb. 25.

When Leonid Brezhnev died in 1982, many observers saw the U.S.S.R. as poised at a major turning point in its history. The country faces serious problems in almost every sphere, with a stagnating economy and industry. Its six East European allies—Bulgaria, Czechoslovakia, East Germany, Hungary, Poland, and Romania—face similar problems, and for similar reasons. Thus, industrial output for the six nations rose 2.7% in 1984, after a decline of 2.0% in 1981, zero growth in 1982, and an increase of 2.8% in 1983, according to Central Intelligence Agency calculations. (The goal was 3.7 to 3.8% a year in 1981-85.)

Since assuming power, Gorbachev, 54, has openly acknowledged problems and attacked Soviet economic and industrial failures. The Soviet leader is carrying out a wholesale overhaul of senior positions, installing a younger generation of managers and policy makers. He has launched a tough campaign against alcoholism, absenteeism, and corruption. And he has set out a strategy to meet three competing basic needs: modernizing an aging and often obsolete industrial base; maintaining growth in defense spending; and preserving consumer and social programs.

His strategy is based on increasing the resources available for these needs by accelerating annual growth for the economy and industry to 4.7% a year through the year 2000. This far exceeds growth during the past decade. Total industrial production rose 3.2% a year in 1976-80, by CIA estimates. (Soviet official statistics are higher because of double-counting and disguised inflation, CIA believes.) Industrial output rose only 2.3% in 1981 and 2.4% in 1982, before rebounding to 3.8% in 1983 and 1984, by CIA figures. Through September this year, industrial output rose 3.7% by official figures. (The target set by the Soviet plan for all of 1985 is growth of 3.9%.)

The Soviet Union and East European nations will follow similar paths in their next five-year plans, emphasizing "intensive" rather than "extensive" development. This means increasing output through higher productivity and more efficient management of resources, rather than by raising inputs of fuel, raw materials, capital investment, and labor. It means trying to modernize existing enterprises, instead of constructing new ones. As one Soviet official says, "We have basically exhausted the extensive methods of development."

Raising the quality of goods and services will be stressed. And there is to be a greater role for market forces such as prices, wages and other incentives, and profits. Increased decision making by individual enterprises is to be tried, and the economic bureaucracy will be streamlined. Experiments with varying degrees of autonomy are now under way at some 2300 Soviet enterprises (representing 12% of total industrial output), as well as in several East European countries. (However, Soviet bureaucracies have been assailed for inhibiting these efforts.)

The key to the strategy is more

Soviet Union is East Europe's largest chemical producer

Thousands of metric tons, 1984	U.S.S.R.	Bulgaria	Czechoslovakia	East Germany	Hungary	Poland	Romania
Mineral fertilizers^a	30,770	695	1191	na	1109	2356	3073
Nitrogen (N)	13,480	486	576	1026	678	1369	na
Phosphate (P ₂ O ₅)	7,660 ^b	209	398 ^b	na	269	869	na
Potassium (K ₂ O)	9,630	—	217 ^c	3465	162 ^c	118 ^c	na
Ammonia^d	17,445	1138	na	na	na	na	na
Sulfuric acid	25,300	908	1240	884	550	2770	na
Sodium hydroxide	2,971	163	325	695	194	379	na
Plastics	4,800 ^e	418	1039	1085	383	593	na
Synthetic rubber	1,850	26	71	152	—	119	159

^a Nutrient content. ^b Includes ground phosphate rock for direct application and phosphate animal feed. ^c Imported potash for producing multinutrient fertilizer. ^d Nitrogen content. ^e Includes resins for man-made fibers. na = not available. Sources: Central Intelligence Agency, U.S. Department of Agriculture, Foreign Broadcast Information Service, PlanEcon Inc., Council for Mutual Economic Assistance

rapid introduction of scientific and technological advances into the Soviet and East European economies. For instance, all Soviet industrial growth is to stem from higher labor productivity, which is to grow 130 to 150% by the year 2000. This includes "computerization of the economy" and focusing resources on electronics, nuclear power, automation, robotics, and production and processing of new materials. Top priority thus goes to accelerating development of the Soviet chemical, mechanical engineering, and electronic and electrical engineering industries.

In October, the Soviet Politburo approved a comprehensive program for "chemicalization" of the economy by the year 2000. It provides for substantial increases in output of mineral fertilizers, pesticides, plastics, synthetic fibers, and other chemical materials. Specialty chemicals will receive particular attention. The program also includes major measures to reconstruct and reequip existing plants, introduce automation and mechanization, install more efficient processes, and add production capacity.

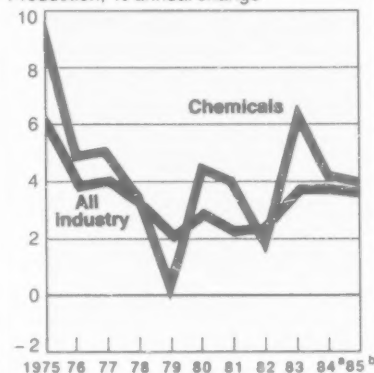
Soviet leaders view accelerated growth of the chemical industry as crucial to progress in other key economic areas, including machinery, agriculture, medicine, construction, and transportation. They also view rapid chemical growth as essential to improving the quality, variety, and convenience of consumer goods.

During the next five-year plan, output of the Soviet chemical industry is to rise 30 to 32%. Labor productivity is to grow 29 to 31%, accounting for almost all growth. Production of mineral fertilizers is to reach 41 million to 43 million metric tons in 1990 (up 33 to 40% from 1984). The target for pesticides is 440,000 to 480,000 metric tons on an active ingredient basis (up 29 to 40%), for plastics 6.8 million to 7.1 million metric tons (up 42 to 48%), and for synthetic rubber 2.7 million metric tons (up 46%). Output of reusable polymer packaging is to triple.

In the next five years, the Soviets will step up R&D on and output of modern structural plastics and other polymer materials; low-bulk chemi-

Chemical growth outpaces that for industry in general

Production, % annual change



■ Preliminary ■ For first nine months. Note: All figures except for 1985 are based on Central Intelligence Agency estimates, which are lower than official Soviet statistics because of postulated upward bias in Soviet figures. Sources: Central Intelligence Agency, U.S.S.R. Central Statistical Administration

cal products, especially organic compounds; vegetable oil and foodstuff substitutes for industrial use; new high-strength, highly elastic, synthetic fibers; radial tires using metal cord, and new large and superlarge tires; and industrial rubber articles.

Chemical industry also has high priority in Eastern Europe. In Hungary last year, chemical output rose 4%, up from just 1% in 1983. Growth was led by gases, up 9%, and pharmaceuticals and plastics, both up 7.5%. Chemicals are Hungary's second largest export, and chemical exports paid for in hard currency rose 10%.

This year, the target is 3.3% growth in chemical output, and 9% in hard currency exports. Through August, production was up nearly 4%, the fastest growth of any Hungarian industry. (Industrial output overall rose just 0.4%.) Pharmaceutical production was up 10% in the first half of 1985, double the target. Nearly two thirds of pharmaceutical output is exported, with a goal of \$140 million in hard currency exports this year. Hungary has received a \$73 million loan from the World Bank to increase production of fine and specialty chemicals oriented toward export, particularly pharmaceuticals.

Romania also targets fast growth for pharmaceuticals, with output

slated to rise 69 to 85% by 1990. It planned ambitious growth of 10.2% a year in chemical output for 1981-85. But its output has lagged well behind, especially in fertilizers and synthetic fibers, because it curtailed imports of crude oil to save hard currency. Czechoslovakia, too, is stepping up production of specialty chemicals, planning to make them a quarter of all chemical production by 1995, and to double the percentage exported (now 21.5%).

East Germany's chemical output rose nearly 12% through this September, surpassing most other industries. However, Bulgaria's chemical growth slowed, with production through September of sodium hydroxide, plastics, and phosphate fertilizers well below 1984 levels. Poland will not meet targets, especially because of a horrendous first quarter. Chemical output in January to March dropped almost 5%, with nitrogen fertilizers down 32%.

A degree of skepticism may be in order over the ambitious goals of the Soviet Union and East European countries in their next five-year plans. Despite its high priority and large investments, the Soviet chemical industry often has failed to meet targets. This year, for instance, fertilizer output was to rise more than 10%, but through September it was up just 6%. Production of pesticides and of plastics was up 4% and of sodium hydroxide and sulfuric acid 2%. Chemical output as a whole was up 4%. The industry has been plagued by poor planning, late completion of projects, difficulties in absorbing foreign technology, and inadequate R&D.

Western analysts point out that despite his talk of "revolutionary solutions," Gorbachev is tinkering with the system to make it work better rather than seeking any fundamental structural change. He apparently does not intend to introduce market forces or private enterprise as China—or Hungary to a more limited extent—is doing. Soviet officials stress the necessity of keeping a great degree of central planning and control. But without such structural reform, western observers believe, the Soviet economy will continue to muddle along and not grow to meet its needs and goals. □